Annual Report for 1977

April 1978

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN-18

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

ANNUAL REPORT FOR 1977

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C O N T E N T S

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INTRODUCTION

The Institute made steady progress in all the research projects undertaken during the year 1977. The important results and highlights of the work done are summarised below.

Marine fish production

The total marine fish landings in India during the year 1977 was provisionally estimated at 1122544 tonnes as against 1352855 tonnes during 1976 showing a decline of 230311 tonnes representing a decrease of about 17%. Except in Kerala and Karnataka the total landings declined in all the maritime states of India.

Characteristics of the major fisheries

Oil sardine catch in 1977 showed a decrease of about 13% over that of the previous year. This decrease was reflected along the coasts of Kerala and Karnataka which are the main centres of oil sardine fishery. This fluctuation may be attributed to the unsuccessful spawning and recruitment to the fishery whereas in the offshore fishing conducted off Mangalore and Karwar, the purse seines netted good catches of oil sardine.

The catch of lesser sardines and anchovies also showed a declining trend during the year. The coastal belt between Cape Comorin and Quilon has been found to be the most productive region for Anchovies. There is a possibility of increasing the catch of this fish between Quilon and Ratnagiri by extending the fishing operations to offshore waters.

Mackerel fishery during the year showed a marginal decrease during 1977 as compared to 1976. The recruitment started earlier in the south than in the north along the west coast. The landings of mackerel along the east coast was 50% less than that of 1976. The one-year old fish dominated the catch along the west coast except in southern observation centres where 0-year old predominated. A review of the mackerel fishery in the country during the past 2 decades showed that the fish shoals remain in the shelf waters throughout the year but mostly confined to shallow region below 30 metres depth. The bulk of the catch in the country comes from the region Quilon to Ratnagiri on the west coast.

The annual average catch was estimated as 70,000 tonnes which forms about 4 per cent of the average marine fish production in the country.

The catch per unit area seems to be higher off Karnataka and Maharashtra than that of Kerala. In spite of continuous exploitation of this species during the last four decades there seems to be no change in the overall size composition of the catches. The stock assessment studies made by the Institute and the aerial surveys conducted by the FFP indicate that the annual potential yield is around 1,27,000 tonnes. In the present area of exploitation the fishing effort is nearing the maximum level and hence for better yields, the fishing operation should be extended to offshore waters, preferably in the April to September season.

Intensive observations on the resources of tunas and related species along the west coast have shown that centres like Mangalore and Calicut are also important for catch of tunas and bill fishes. The catch of sailfish in the Calicut region has shown considerable increase during the year.

The scientists of the Institute participated in the Indo-Polish survey conducted off Bombay Gourashtra coast. Preliminary analysis of the data showed that the total catch and catch rates were better by pelagic trawl than the bottom trawls. The demersal fishing operations at Kakinada and Waltair showed that the catch rate was better during the year as compared to 1976

Mariculture

The Institute made further progress in developing and improving the techniques of culturing marine fishes, prawns molluscs and seaweeds. Without much complicated management procedures, culture of species such as mullets and milk fish with a production rate of 857.5 kg/ha/annum was made possible on a demonstration basis. Eight of our commercially important prawns have been successfully reared from egg to marketable size under controlled conditions. It has also been demonstrated that by intensive culture of some of these species on scientific lines, it would be possible to raise them at a rate of 1 to 1.5

thousand kg/ha/annum.

New system of rearing prawn larvae:

A new system of rearing prawn larvae has been developed at Narakkal using 6' diameter plastic pools illuminated with fluorescent tube lights. In this system the prawn larvae and food organisms are cultured together in seawater fertilised with nitrates, phosphates and silicates. The tube lights provide the necessary light energy for photosynthesis.

A method of collecting and purifying the eggs of Artemia grown as a continuous culture at Narakkal has been developed.

Polyculture

At Narakkal, Chanos stocked with prawns at a density of 3000 fingerlings/ha grew rapidly, without any artificial food from 45 mm to 330 mm in a period of about 3½ months and yielded a harvest of 435 kg/ha with a survival rate of 60-70%.

Spawning of Penaeus semisulcatus:

For the first time, the prawn, Penaeus semisulcatus spawned under controlled conditions in the field laboratory at Kovalam near Madras. The eggs were reared upto post larval stage. The larval development was completed within 13-14 days.

Open sea green mussel culture:

At Calicut, 10 rafts covering an area of 450 sq.m. were moored in the open sea. 533 ropes each 8 metre long were seeded with 4 kg. of spats of mussels per rope and were suspended from November 1976. When harvested in May 1977 the average production was 36 kg/8m rope giving approximately an yield of 80 metric tonnes. This demonstrates that green mussel culture in the open coastal waters is economically feasible.

Similarly good progress was shown in the mussel culture farm at Kovalam near Madras and at Vizhinjam.

Edible oyster culture

In the Karappad creek near Tuticorin, experiments have been conducted on the farming of edible oyster, Crassostrea madrasensis with significant results. The oysters were reared in rectangular iron framed trays with nylon netting, serially arranged on racks made up of casurina poles erected across the creek. These oysters were collected from natural beds when they were only 25-35 mm in length. These oysters registered faster rate of growth than those in the natural beds and within 12 months they reached the marketable size of 100-110 mm in length. The mortality rate which is as high as 25-30% in natural beds was brought down to 5% in the culture farm and further the percentage of edibility was also enhanced. This is the first time that an attempt is made in India to raise commercial quantities of edible oysters by culture methods.

Other molluscs cultured:

Experimental culture of the clam, Meretrix casta in wooden cages has been taken up at Porto Novo. Growth rate was observed to be better than that in the natural beds. At Kakinada, the cockle, Anadara granosa is being cultured in latern type cages suspended from ropes in the bay.

Pen culture

Pen culture has been introduced at Mandapam Camp and Tuticorin. The pens are simple in design, with the enclosure built of double layered seasoned split-bamboo screens which are fastened together with straps. The pen is usually square with an enclosed area of about 200 sq.m. The whole structure is well propped up with casuarine poles and the submersible portion are coated with coaltar. The pens are at present stocked with Chanos chanos. The fingerlings of this species are available in good numbers in the coastal waters and this fish grows fast and attains a weight of one kg. in a year.

As the farming depends upon fry collected from littoral waters, there is the possibility of developing ancillary industries in which trained women and children can be employed for fry collection as in Philippines, Taiwan and Indonesia. Similar pens have been set up at Kovalam (near Madras) and Mulki near Mangalore.

Seaweed Culture:

The seaweed culture at Mandapam is progressing very well. It is felt that seaweed could be cultured on a large scale on the peripheral areas in a systematic manner. Experimental cultivation of Gracilaria edulis on coir frames has shown that the yield would be 5.5 kg of fresh seaweed per square metre of rope. In the case of Sargassum a growth of 37-52 cm. from an initial height of 10cm. was observed in forty days. Gelidiella acerosa registered a growth of 3 kg from an initial weight of 1 kg- in 77 days.

Anchovy culture:

At Vizhinjam experiments have been initiated to culture anchovies in cages made of nylon mesh reinforced with frame work made of cane. Each cage can hold upto 5000 anchovies and these are suspended from rafts in the bay. The success of this experiment would pave the way for supplying bait fishes for the tuna live bait fisheries of Lakshadweep islands where there is scarcity for bait fishes.

Blending sea farming with traditional capture fisheries

Although marine fisheries development in the country has been impressive during the past 30 years, it is felt that the benefits accrued have not helped the poor fishermen engaged in small scale indigenous fisheries whose per-capita income has hardly improved. In order to benefit the fishermen and their

family members whose labour potential has not been fully utilised, it is conceived that blending of culture fisheries with normal capture fisheries would greatly help to enhance the production and the earnings of the rural community. An Operational Research Project has been drawn up for implementing this scheme at Kovalam near Madras. This village has 175 families comprising a total of 975 fishermen. The per-capita income is Rs. 369 per annum. The project will train the fishermen in the methods of mariculture of fishes, prawns and molluscs so that these could be undertaken along with capture fisheries. This would also create a sense of involvement and participation in the seafarming techniques evolved by the Institute and demonstrate the scope for overall improvement of socio-economic conditions of the area. The integrated approach to blending culture fisheries with capture fisheries for rural development is a new concept in marine fisheries sector.

National tagging programme:

During the year 4268 oil sardines, 512 mackerels and 4128 prawns were tagged and released in the sea off Cochin. In the backwaters 7794 prawns were tagged. Cat fishes were also tagged and released off Maltair.

Pollution monitoring:

The scinetis s of the Institute invesigated the causes of mortality of fishes in the Chaliyar River near Calicut. The organic waste discharged from the Mavoor Rayon pulp Factory into Chaliyar river creates high BOD during summer months when the flow of water in the river is meagre. Experiments conducted on phyto-toxicity using 14 methods showed that toxicity extended to 16 km down stream and the effect of pollution gets dissipated only during monsoon months when the river flow improves.

Brief history of the Institute

The Central Marine Fisheries Research Institute was established in February 1947 under the Union Ministry of Food and Agriculture. In October 1967 the administrative control of the Institute was transferred to the Indian Council of Agricultural Research, New Delhi.

Objectives of the Institute

i) To estimate the catches of marine fishes and other animals from the seas around India throughout the year by different types of vessels and gears and the effort expended,

ii) to conduct researches on marine fisheries resources in order to step up their production to the maximum possible extent,

iii) to locate new fishing grounds and untapped resources; to conduct environmental studies in relation to fisheries,

iv) to recommend measures for the rational exploitation of the various resources,

v) to develop techniques for the culture of suitable species of marine animals and plants for augmenting natural production, and

vi) to organise suitable education, extension and training programmes so as to transfer the technology to the masses.

Organisational set up

The Institute has five divisions, viz. Fishery Resources Assessment, Fishery Biology, Crustacean Fisheries, Molluscan Fisheries and Fishery Environment. The subordinate establishments include Regional Centre at Mandapam Camp and Research Centres at Veraval, Bombay, Karwar, Mangalore, Calicut, Vizhinjam, Tuticorin, Madras, Waltair, Kakinada, Minicoy and Port Blair; and 30 Field Centres along the east and west coasts of India.

.ibrary

During the year, the Indian Journal of Fisheries Vol.22 ios 1 & 2 and CMFRI News letter Nos. 5 and 6 were published.

About 561 books and 600 new numbers of periodicals were idded to the library. As usual the library facilities were itilized by different Universities, Institutes, Central and itate departments and interested individuals.

raining offered

earl culture technicians training course:

At Tuticorin a six-month training course in pearl culture as successfully completed during the year. The nine trainees ainly comprised of those sponsored by the governments of Gujarat, erala and Tamil Nadu. The trainees were given full theoretical id operative training on all aspects of pearl culture and all the rainees were able to produce cultured pearls by themselves and are i a position to take up the work independently in their respective tates.

Another batch of 8 trainees were imparted a short-term 5 iek course on pearl oyster farming and production of cultured pearls. ie intensive training concluded on 23rd September, 1977 and the ainees expressed that they have attained sufficient proficiency in earl culture operations.

ishi Vigyan Kendra:

The Krishi Vigyan Kendra set up at Narakkal completed a one nth training course to the first batch of 10 fish farmer trainees the methods of mariculture of fishes, prawns and molluscs so that ey could take up this work in their own fields or farms. Subse- ently two more batches of fish farmers were trained.

mmer Institute in breeding and rearing marine prawns:

A Summer Institute in breeding and rearing of marine prawns s conducted at Cochin between 11th May and 9th June, 1977. The stitute was attended by 16 participants sponsored by various State vernments, Universities and other institutions. The programme

included lectures in taxonomy, biology and ecology of the cultivable species and practical demonstration and training in the collection of spawners, their identification, transportation and breeding and rearing of eggs and larvae. They were also familiarised with various aspects of industrialised farming.

Deputation abroad

Dr. E.G. Silas, Director proceeded on deputation to Philippines to participate in the International Seminar on Fisheries Research Management organised by the Aquaculture Dept. of the South East Asian Fisheries Development Centre during December 1977.

Dr. G.Luther, Scientist was deputed to undergo training on board R.V. Explorer, a research vessel of the Dept. of Agriculture and Fisheries for Scotland during her voyages in the west coast of Scotland and the North sea during October-November 1977.

Advisory/Consultancy service provided

1. Dr. E.G. Silas, Director, served as:

   1. ICAR representative on the General Council and Executive Committee of the Kerala Agricultural University, Mannuthy, Trichur.
   2. Member on the joint ICAR - ICSSR Scientific Panel for Social Sciences and Agricultural Extension.

3. Member, Programme Priorities and Cruise Committee for the National Institute of Oceanography, Goa.
4. Member, Research Advisory Committee of the Kerala Agricultural University, Trichur.
5. Member, Kerala State Fisheries Research Committee.
6. Member, Central Advisory Committee on Exploratory Survey of Marine Fisheries.
7. Member, Tamil Nadu State Fisheries Research Council.
8. Member, Regional Committee No.8 (constituted by the Governing Body, ICAR)
9. Member, Scientific Panel for Fisheries Research, ICAR.
10. Member, Kerala State Fishery Advisory Board.
11. Member, High Level Aquarium Committee - Construction of a Marine Aquarium at Cochin.
12. Member in the Committee on Fisheries and other Aquatic Resources of the State Committee on Science and Technology, Kerala.
13. Member, Central Government Employees Co-ordination committee, Cochin.
14. Member, Faculty of Marine Sciences, University of Cochin.
15. Member, Executive Council and Vice-President, Indian Society of Ichthyologists, Madras.
16. Member, the Board of Management of Konkan Krishi vidyapeeth, Dapoli, Maharashtra.
17. Member, Technical Committee of the Marine Products Export Development Authority, Cochin.

18. Member, Board of Studies in Zoology(Post-Graduate) and Zoology(General and Pass) of the University of Madras for a period of three years from 20-3-76.
19. Member, Expert Committee of the Madurai University, Madurai, constituted for framing the rules, regulations and syllabus for B.Sc., Marine Science.

Advisory service provided (contd)

Dr. C.S. Gopinadha Pillai, Scientist of the Institute attended the Third International Symposium on coral Reefs held at Miami, Floride during May 1977. He served as an Advisor to the Symposium which was sponsored jointly by the University of Miami, U.S. Geological Survey and Smithsonian Institution, U.S.A..

The Director nominated Dr. P.V.Ramachandran Nair Scientist to assist Central Co-ordinating Authority for dealing with major oil spillages in seas.

Director has nominated Dr. P.Vedavyasa Rao, Scientist, to represent the Institute as a Member of the Sub-Committee on Exploratory Survey of Marine Fisheries, Government of India, in the place of late Dr. K.V. Sekharan.

The Institute was consulted by the Pondicherry Industrial Promotion Development and Investment Corporation Ltd., for technical advice regarding the setting up of a prawn-culture farm in Pondicherry. Shri M.S.Muthu and Shri S.Rajan, Scientists of the Institute, were deputed to visit all the estuaries and backwaters in the territory to select suitable places for the farm sites.

The Institute rendered its consultancy service to a number of interested individuals and organisations on many problems relating to capture and culture fisheries.

List of distinguished visitors

1. R. Srivastava, Managing Director, Pondicherry Industrial Development Corporation, Pondicherry, 22-1-76

2. Josena C. Madamba, Director General, Philippine Council For Agricultural and Resources Research, Los Banos, Laguna, Philippines, 26-11-76.

3. J. Vander Meulen, FAO/UN Representative in India, New Delhi, 3-2-77

4. Freeman Compton, and Aeves Andrianov Centre for Development of Traditional Fishing Communities, FAO/HO(SWE), Colombo, 8-2-77

5. Dr. Leo Rijavec, UNDP/FAO Pelagic Fisheries Project, Cochin, 10-2-77

6. Dr. R.L. Kaushal, Vice-Chancellor, Agricultural University, Jabalpore, 22-2-77.

7. Commander Narendra Singh, Director (Oceanography), Dept. of Science & Technology, New Delhi, 28-2-77.

8. Dr. Rudolph Prakop, Dept. of Palaeontology, National Museum, Prague, Czeckoslovakia, 15-3-77.

   Dr. Vaclav Pfleger, Dept. of Zoology,

9. Mr. J.D. Joysingh, Member-Secretary, Water Pollution Control Board, Trivandrum, 18-3-77.

10. Mr. J.Vidal, C/o UNDP, Bahrain, 21-3-77.

11. Mr. John K. Harmer. Attorney at Law, Sun Harbour Industries, California, on 28-4-77.

12. Mr. R.L.Chapman, and Sun Harbour Industries, California, on 28-4-77.

    Mr. Henry R. Branstetter,

13. Mr. Ebrahim Abdul Rahim, Fisheries Resources Bureau, Bahrain, on 28-4-77.

14. Mr. T. Zeinklever, Ex-Advisor, Polish Consulate, Bombay, on 18-5-77.

15. Mr. John E.Frazer, Staff Writer, Readers Digest, on 23-5-77.

16. Dr. Robin Willas, IDRC, Singapore, on 10-6-77.

17. Dr. A.C.Winsor, FAR(IDP) Rome, 8-7-77.

18. Mr. A Bulgarian Delegation consisting of Mr. K.Kutzanov, Bulgaria, Mr. B.V. Sokolor, Bulgaria; Mr. Valtchann, Bulgarian Embassy, New Delhi; and Mr. J.B. Daryani, New Delhi, on 26-7-'77.

19. Commodore Talibuddin, Naval Officer, on 9-8-77.

20. Mr. Maher Mourad Shafik, Cairo, Egypt & Mr. Mamdouh Thobet Kheir, Egypt on 23-8-'77.

21. Mr. A.M. Pradhanan, Nain Shah & K.R.Kesharaj, Scientists, Nepal on 24-8-'77.

12. Mr. O. Bakarae, Chief Fisheries Officer, Lagos, Nigeria, on 17-9-77.
13. Mr. Surendranath Ramgoolam, Mauritius, on 19-9-77.
14. Mr. Gordon M. Medford, Ministry of Education and Culture, Barbados, on 19-9-77.

A six-man delegation from the Aquaculture Dept. of the South East Asian Fisheries Development Centre, Iloilo, Philippines visited the Research Centres of the CMFRI at Madras, Tuticorin, Vizhinjam and also the Prawn culture Laboratory at Narakkal in the month of November.

Exhibitions

The Institute participated in an exhibition organised by the CPCRI at Kasargode between 27-10-76 and 8-1-77 in connection with the Diamond Jubilee of Coconut research in India. The Institute participated in the exhibition organised on the occasion of the foundation laying of the Fresh Water Fish Culture and training centre at Dhauli during January, 1977.

Calicut Research Centre of CMFRI was awarded Gold Medal for their exhibits at the Calicut Health Education & Industrial Exhibition, 1977.

In connection with the Silver Jubilee celebrations of the Integrated Fisheries Project at Cochin, an 'Open House' and Fair was organised by them in which the Institute also participated.

There was an exhibition and a seminar on Integrated Development Plan for Malappuram and Fifth Anniversary of Farm and Home Programme of All India Radio held at Malappuram between 26-11-76 and 5-12-76. The fisheries part of the exhibition and seminar included coastal fisheries in which the Institute was represented by Calicut Research Centre.

The Institute was represented by the Goa Research Centre in the exhibition on Fisheries conducted under the auspices of Shri Damodar College of Commerce and Economics, Goa.

The Institute also participated in the exhibition in connection with the Centenary celebrations of the Maharaja's College, Ernakulam in January, 1977.

The Institute projected its research and development activities in the ICAR pavilion of the "Agri-Expo 77" held at New Delhi in November 1977.

These exhibitions attracted large crowds and were visited by many distinguished personalities and the Institute depicted its activities and achievements especially in the fields of mariculture of fishes, prawns, molluscs and sea weeds.

Seminars

In connection with the Vth session of the Indian Ocean Fisheries Commission held at Cochin during October, 1977, Dr. E.G. Silas, Director served as one of the advisers in the Indian delegation. He introduced the subject on the ' Present knowledge of the fishery resources of the Indian Ocean' under the Agenda item on 'Effects of extended jurisdiction of fisheries' and led the discussion on the subject.

On this occasion a technical document entitled 'Indian Fisheries, 1947-77 was brought out. The Director of the Institute was the Convenor of the Souvenir sub-committee for the preparation of this document and was also its Chief Editor. The Scientists of the Institute contributed to various chapters of this book.

A seminar on 'Marine Algae' was held under the auspices of the seaweed Research and Utilization Association of India at the Regional Centre of CMFRI, Mandapam Camp on 17-1-77 and the scientists of the Regional Centre participated in the seminar and presented papers also.

Dr. K.Alagarswami, Scientist of the Institute gave a talk on pearl culture in Tamil over the All India Radio Madras, on 4-10-77. He explained the various aspects of pearl culture and answered queries raised by the villagers who also participated in the Rural Radio science gathering.

Keel laid for Fisheries Research Vessel

Dr. M.S. Swaminathan, FRS, Director-General, ICAR performed the formal keel laying ceremony of the Fisheries Research Vessel at the yard of Garden Reach Shipbuilders and Engineers, Calcutta on 25-2-1977. The 107' vessel is designed for multiple type of fishing operations and research, e.g. trawling & purse seining and fisheries biological and environmental research.

Cadalmin II

Dr. M.S. Swaminathan has also formally inaugurated the Institute's 43½ Foot Research Vessel, Cadalmin II at Mandapam Camp on 5-5-77. The vessel was built by the Tamil Nadu State Fisheries Development Corporation at the Mandapam Boat Building yard and is designed for conducting exploratory fishing and environmental investigations. It has a small laboratory and accomodation for seven persons including scientists.

Obituary

It is recorded with profound grief the sudden demise of Dr. K.V. Sekharan, Scientist-S 3 on 25-3-1977. Dr. Sekharan was heading the Fishery Biology Division of the Institute since his appointment as Senior Fishery Scientist in 1972. He joined the Institute in 1951 and has served in various capacities almost continuously except during a short period when he was on foreign service at the University of Agricultural Sciences, Bangalore and the University of Calicut. He has made notable contributions in the field of fishery biology.

The sad demise of Dr. N.K. Panikkar on 24-6-1977 is recorded with grief. Dr. Panikkar was a former Director of the Institute from 1951 to 1957. Dr. Panikkar has served the Govt.of India as the Fisheries Development Advisor. He was the Director of the NIO till his retirement and later the Vice- Chancellor of the Cochin University.

PROGRESS OF RESEARCH

FISHERIES RESOURCES ASSESSMENT DIVISION

Salient features

The provisional estimates of All India marine fish landings were 1.12 million metric tonnes in 1977 against 1.35 million tonnes in 1976, showing a decrease of about 17%. Reconciliation of estimates obtained by the Institute and that by State Governments is being initiated so as to arrive at the final figures shortly.

The series of cyclones along the east coast during November paralysed fishing operations especially in the Krishna district of Andhra Pradesh and Tanjore District of Tamil Nadu.

Purse seine fishery for pelagic species is fast developing in the Karnataka region with a catch of about 24,000 tonnes during the year.

Coding and punching of fishery data have been initiated at the National Fishery Data Centre and the Computer Centre at Cochin Shipyard Ltd., has been approached for processing the data.

Out of 21 vacancies for the Field staff, 17 have been filled up and action has been taken to recruit suitable staff for remaining vacancies of field staff, Punch Card Operators and Computors.

Sample survey for estimation of marine fish production and the effort expended (FSS/FRA/FS 1.1)

K. Alagaraja, S.K. Dharmaraja, MG. Dayanandan, C.R. Shanmugavelu, Varugese Philippose, K. Narayana Kurup, B.Prasanna Kumari, K. Balan, U.K. Satyavan, K. Vijayalakshmi, Vargese Jacob, K. Nandakumaran, G. Balakrishnan, Computors and other Field staff.

Annual production of marine fish

The total marine fish production in India during the year 1977 was provisionally estimated at 1122,544 tonnes as against 1352,855 tonnes during 1976 showing a decline of 230,311 tonnes

representing a decrease of about 17% as compared to the estimates for 1976. Excepting in Kerala, Karnataka and Andamans the total landings declined in all the maritime States. The statewise marine fish landings in India during the years 1977 and 1976 are shown in Table I.

Table - I

Statewise Marine Fish Landings in India (In tonnes)

State	1977	1976
1. West Bengal	5,266	25,411
2. Orissa	12,468	29,823
3. Andhra Pradesh	100,625	131,321
4. Tamil Nadu	205,735	226,078
5. Pondicherry	6,462	10,123
6. Kerala	339,578	331,047
7. Karnataka	96,175	95,283
8. Goa	24,559	34,968
9. Maharashtra	188,729	293,601
10. Gujarat	139,233	171,294
11. Andamans	1,499	1,334
12. Lakshadweep	2,215	2,572
Total	1122,544	1352,855

West Bengal

The total landings declined sharply by 20,145 tonnes (Table I). This was mainly due to the poor fisheries of sciaenids, non-penaeid prawns, penaeid prawns, Harpodon nehereus, other clupeids and Thrissocles; the reduction in the landings of the above fisheries being 3,354 tonnes, 2,490 tonnes, 1,685 tonnes, 1,405 tonnes, 1,208 tonnes and 1,053 tonnes respectively.

Orissa

A reduction in the total landings to the tune of about 17,000 tonnes was noticed in this State during the year 1977. (Table I). A substantial decline in the landings of pomfrets, Hilsa ilisha, elasmobranchs, cat fishes, lesser sardines and seer fish by 9,954 tonnes, 3,276 tonnes, 1,730 tonnes, 1,095 tonnes, 430 tonnes and 396 tonnes respectively accounted for the sharp decline in the total landings. However, an increase in the landings of other Hilsa, other clupeids, Anchoviella and penaeid prawns by 247 tonnes, 153 tonnes, 147 tonnes and 100 tonnes respectively was also noticed.

Andhra Pradesh

The total landings decreased by about 30,700 tonnes. (Table I) This may be due to the effect of cyclone in the State in November 1977, particularly in the districts of Nellore, Prakasam, East Godavari and Krishna. The fisheries of lesser sardines, other clupeids, penaeid prawns, ribbon fish, Anchoviella, pomfret, polynemids and mackerel suffered a set back the reduction in their landings being 12,354 tonnes, 6,047 tonnes, 3,975 tonnes, 3,897 tonnes, 2,362 tonnes, 1,559 tonnes, 1,115 tonnes and 1044 tonnes respectively. The catch of non-penaeid prawns, Leiognathus spp, perches, Harpodon nehereus and Saurida & Saurus, however, showed an increase by 4,242 tonnes, 2,027 tonnes, 976 tonnes, 746 tonnes and 709 tonnes respectively.

Tamil Nadu

A reduction to the extent of about 20,000 tonnes in the total landings was noticed (Table I). The cyclone which affected the east coast of India was responsible for the significant fall in the total landings as was seen in Andhra Pradesh. The landings of ribbon fish, other clupeids, Leiognathus spp, crabs and other crustaceans, mackerel, elasmobranchs and flying fish sharply declined, the reduction being 14,461 tonnes, 13,200 tonnes, 11,890 tonnes, 5,395 tonnes, 4,814 tonnes, 793 tonnes and 706 tonnes

respectively. An increase in the landings of cat fishes, Anchoviella, sciaenids, seer fish perches and lesser sardines by 10,169 tonnes, 5,519 tonnes, 3,194 tonnes, 2,641 tonnes, 2,502 tonnes and 1,089 tonnes respectively, was also noticed.

Pondicherry

The total landings decreased by 3,661 tonnes. The fisheries of mackerel, lesser sardines, perches, ribbon fish, crabs and other crustaceans, sciaenids and Leiognathus spp were comparatively poor, the reductions in these landings being 1200 tonnes, 683 tonnes, 378 tonnes, 285 tonnes, 220 tonnes, 176 tonnes and 164 tonnes respectively. The cyclone along the east coast affected the fishing in this State also. The landings of Anchoviella, elasmobranchs, Thrissocles and cat fishes, however, showed an increase of 370 tonnes, 187 tonnes, 160 tonnes and 71 tonnes respectively.

Kerala

An increase of about 8,500 tonnes in the total landings was noticed in this State. The landings of lesser sardines, oil sardines, tunnies, cat fishes, seer fish, red mullets, elasmobranchs and Thrissocles decreased by 13,848 tonnes, 9,780 tonnes, 6,196 tonnes, 4,883 tonnes, 2,927 tonnes, 2,337 tonnes, 1,633 tonnes and 1,082 tonnes respectively. But this decrease was more than compensated by the increase in the landings of perches, penaeid prawns, Carangs, Saurida & Saurus sciaenids, Leiognathus spp, Crabs & crustaceans and pomfrets by 10,979 tonnes, 5,671 tonnes, 5,062 tonnes, 5,010 tonnes, 4,919 tonnes, 3,272 tonnes and 2,804 tonnes respectively.

Karnataka

The total landings marginally increased by about 900 tonnes. A substantial increase in the landings of mackerel, elasmobranchs, other clupeids, perches, cat fishes, penaeid prawns and seer fish by 3,758 tonnes, 1,718 tonnes, 1,178 tonnes, 1,035 tonnes, 871 tonnes, 566 tonnes and 490 tonnes respectively was noticed. However, the landings of oil sardines, Leiognathus,

ribbon fish and sciaenids showed a decline of 10,315 tonnes, 2,578 tonnes, 887 tonnes and 554 tonnes respectively.

New developments in purse-seine fishing

Out of the total of 96,000 tonnes in 1977 the purse-seine landings contributed about 24,000 tonnes, in Karnataka, forming about 25% of the total landings in this State. The purse-seine landings at Mangalore, Malpe, Polipu, Mulky and Gangoli alone amounted to 22,000 tonnes. Mackerel (56%) and oil sardines (38%) contributed to the catch.

Goa

A decline of about 10,400 tonnes in the total landings was noticed in this State. The landings of lesser sardines, penaeid prawns, ribbon fish, oil sardine, Leiognathus, elasmobranchs and crabs and other crustaceans declined by 7,037 tonnes, 3,207 tonnes, 697 tonnes, 578 tonnes, 438 tonnes, 434 tonnes and 334 tonnes respectively. An increase in the landings of mackerel and Carenx by 1,210 tonnes and 355 tonnes was however, noticed.

Maharashtra

The total landings declined sharply by about 105,000 tonnes. The principal fisheries of this State suffered a set back. A fall of 22,782 tonnes, 20,743 tonnes, 16,079 tonnes, 6,620 tonnes, 5,786 tonnes, 4,166 tonnes, 3,166 tonnes, 1,721 tonnes and 1,675 tonnes in the landings of non-penaeid prawns, penaeid prawns, Harpodon nehereus, sciaenids, pomfrets, ribbon fish, cat fishes, eels and elasmobranchs respectively which constitute the principal fisheries of the State was witnessed during the year. An increase of 818 tonnes in the landings of perches was, however, noticed.

Gujarat

A decline in the total landings to the tune of about 32,000 tonnes was seen in this State during the year. This was mainly due to the failure of the fisheries of Harpodon nehereus, non-penaeid prawns, penaeid prawns, perches, ribbon fish, other clupeids and Saurida & saurus the reduction in these landings being 7,902 tonnes, 6,578 tonnes, 4,647 tonnes, 4,291 tonnes, 3,782 tonnes, 3,722 tonnes, 3,184 tonnes and 2,756 tonnes respectively. A substantial increase in the landings of sciaenids, eels, pomfrets cat fishes and elasmobranchs was also seen. The increase being 4468 tonnes, 4422 tonnes, 4291 tonnes, 4060 tonnes and 2754 tonnes respectively.

Variety Composition

The specieswise estimates of total marine fish landings in India during the year 1977 and 1976 are shown Table 2.

Table - 2

The Composition of Total Marine Fish Landings in India During 1977* as compared to that of 1976 (In Tonnes)

Sl.No.	Name of fish	1977	1976
1.	Elasmobranchs	52,219	54,605
2.	Eels	10,836	8,296
3.	Cat fishes	48,426	43,540
4.	Chirocentrus	9,647	10,368
5. (a)	Oil sardines	147,073	169,262
(b)	Other sardines	65,172	100,000
(c)	Hilsa ilisha	3,396	7,842

* Provisional

Sl.No.	Name of fish	1977	1976
	(d) Other *Hilsa*	11,928	8,482
	(e) *Anchoviella*	34,022	30,069
	(f) Thrissocles	9,689	17,660
	(g) Other clupeids	32,500	57,164
6.	(a) *Harpodon nehereus*	62,404	87,075
	(b) *Saurida* and *Saurus*	8,384	5,292
7.	*Hemirhamphus* and *Belone*	2,327	1,169
8.	Flying fish	643	1,439
9.	Perches	30,583	18,162
10.	Red mullets	1,632	5,216
11.	Polynemids	3,510	14,573
12.	Sciaenids	88,933	87,581
13.	Ribbon fish	36,282	64,542
14.	(a) *Caranx*	29,959	25,745
	(b) *Chorinemus*	3,910	3,322
	(c) *Trachynotus*	81	35
	(d) Other carangids	219	1,572
	(e) *Coryphaena*	225	261
	(f) *Elacate*	428	383

Sl.No.	Name of fish	1977	1976
15. (a)	Leiognathus	34,294	42,445
(b)	Gazza	61	966
16.	Lactarius	9,273	12,045
17.	Pomfrets	26,801	37,701
18.	Mackerel	61,213	65,497
19.	Seer fish	18,875	20,159
20.	Tunnies	12,811	19,322
21.	Sphyraena	2,347	2,388
22.	Mugil	2,234	2,613
23.	Bregmaceros	19	380
24.	Soles	10,419	10,088
25. (a)	Penaeid prawns	86,069	114,640
(b)	Non-Penaeid prawns	54,227	76,787
(c)	Lobster	995	2,532
(d)	Crabs	18,647	19,999
26.	Cephalopods	9,249	10,826
27.	Miscellaneous	80,582	90,812
	T o t a l	11,22,544	13,52,855

Exploratory Survey

The off-shore catch data of the Exploratory Fishery Project vessels were processed for the 9 bases Bombay, Goa, Mangalore, Cochin, Tuticorin, Madras, Vishakapatnam, Calcutta and Port Blair. The catch details are shown in Table 3.

Table : 4

CENSUS OF FISHERMEN POPULATION AND FISHING CRAFTS*

State	Fishermen population				(Fishing crafts)		
	Male	Female	Children	Total	Active fishermen	Mechanised	Non Mechanised
1. West Bengal	3,611	3,242	4,733	11,586	2,595	2	331
2. Orissa	14,158	14,042	21,296	49,496	12,481	56	6,336
3. Andhra Pradesh	75,558	72,235	89,677	237,470	64,592	418	26,004
4. Tamil Nadu	93,718	91,172	103,696	288,586	68,317	1,533	30,501
5. Pondicherry	4,676	4,791	6,957	16,414	3,785	47	1,767
6. Kerala	125,443	125,122	139,816	390,381	81,010	1,026	21,608
7. Karnataka	26,368	27,100	34,857	88,325	18,829	1,044	5,345
8. Goa	6,888	5,606	3,785	16,279	4,569	192	1,259
9. Maharashtra	47,803	50,046	103,574	201,423	41,539	2,034	8,288
10. Gujarat	29,788	31,060	63,733	124,586	22,518	1,734	4,206
Total	428,011	424,406	572,129	1424,546	320,235	8,086	105,647

*Provisional

Pelagic and Demersal Groups of Fishes.

The specieswise estimates of marine fish production in India during 1977 have been grouped into Pelagic and Demersal and analysed as follows:-

According to Jones and Banerji (1968) pelagic group consists of Chirocentrus, oil sardine, other sardines, Hilsa ilisha, other Hilsa, Anchovies and white baits, other clupeids, Bombay duck, Hemiramphus & Belone, flying fish, ribbon fish, carangids, scomberoids, Sphyraena, Mugil & Bregmaceros and the demersal group consists of elasmobranchs, eels, cat fishes, Saurida & Saurus, perches, red mullets, polynemids, sciaenids, silver bellies, Lactarius, pomfrets, soles, penaeid prawns, non-penaeid prawns, lobsters, other crustaceans and cephalopods.

As per the above grouping, the estimated catch of pelagic group of fishes during the year 1977 were 589,738 tonnes as compared to 746,885 tonnes during 1976. Similarly, the demersal group of fishes during 1977 were estimated at 532,806 tonnes as compared to 605,970 tonnes.

Pelagic group of fishes.

The following salient features were noticed in respect of important fishes under this group.

1. Oil sardine.

Total all India landings of oil sardine declined by about 22,000 tonnes (Table 2). This was due to poor fishery in the States of Kerala, Karnataka and Goa during the first and fourth quarters.

2. Mackerel.

The landings of mackerel during 1977 declined by 4,284 tonnes as compared to 1976 (Table 2). While Karnataka and Goa recorded higher landings (IVth quarter), Andhra Pradesh (1st quarter), Tamil Nadu and Pondicherry (1st, IInd and IIIrd quarters) recorded poor landings during the year.

3. Bombay duck.

An overall decrease of 24,671 tonnes in the landings was noticed during 1977 as compared to 1976 (Table 2). This was due to reduced landings in the States of Maharashtra (2nd and IVth quarters) and Gujarat (1st and IVth quarters).

4. Lesser sardines.

The landings of lesser sardines showed a decline of about 35,000 tonnes during the year 1977 over the landings during 1976 (Table 2). While Tamil Nadu (IVth quarter) accounted for higher landings, Orissa (1st and IVth quarters), Andhra Pradesh (1st quarter), Pondicherry (IIIrd quarter), Kerala (1st and IVth quarter) and Goa (1st and IVth quarters) recorded poor landings.

5. Other clupeids.

A decline to the tune of about 25,000 tonnes in the landings of other clupeids was noticed during the year (Table 2). Excepting Karnataka (1st and IVth quarters) all the maritime States recorded poor landings of other clupeids.

6. Ribbon fish.

The landings of ribbon fish declined by 28,000 tonnes (Table 2). This was mainly due to the poor fishery in all the maritime States, barring Orissa.

7. Tunnies

A decline of about 6,500 tonnes in the landings of tunnies during 1977 was noticed as compared to 1976 (Table 2). This was mainly due to lesser landings in Kerala during 1st and IVth quarters.

Demersal group of fishes.

Under the demersal group, the salient features noticed in respect of the major fisheries were as follows:

1. Penaeid prawns.

A substantial decline to the tune of about 28,600 tonnes was noticed during 1977 as compared to 1976 (Table 2). Poor landings of penaeid prawns in the States of West Bengal (1st & IVth quarters), Andhra Pradesh (IIIrd & IVth quarters) Goa (IIIrd quarter), Maharashtra (1st & IVth quarters) and Gujarat (1st & IVth quarters) accounted for the reduction in the total all India landings. Orissa (1st quarter), Kerala (1st, IInd and IIIrd quarters) and Karnataka (1st & IVth quarters), however, recorded comparatively higher landings during the year.

2. Non-penaeid prawns.

The landings of non-penaeid prawns showed a downward trend, the reductions during 1977 being about 22,600 tonnes, as compared to 1976 (Table 2). While Andhra Pradesh (IInd and IIIrd quarters) recorded comparatively higher landings of non-penaeid prawns, West Bengal (1st & IVth quarters), Maharashtra (IVth quarter) and Gujarat (1st and IVth quarters) recorded poor landings.

3. Perches.

A substantial increase of about 12,400 tonnes in the landings of perches was noticed during 1977 as compared to 1976 (Table 2). This was possible because of higher landings in the States of Andhra Pradesh (1st & IInd quarters), Tamil Nadu (1st & IInd quarters), Kerala (1st & IIIrd quarters), Karnataka (1st quarter), Maharashtra (1st & IVth quarters). But Pondicherry (IIIrd quarter) and Gujarat (1st and IVth quarters) recorded poor landings.

4. Polynemids.

The landings of polynemids during 1977 showed a decline of about 11,000 tonnes (Table 2). Excepting Orissa, all the maritime States recorded lesser catches of polynemids.

5. Sciaenids.

A marginal increase of about 1,400 tonnes in the landings of sciaenids was noticed (Table 2). While Tamil Nadu, Kerala, Goa and Gujarat recorded higher landings, West Bengal, Orissa, Andhra Pradesh, Pondicherry, Karnataka and Maharashtra recorded poor landings.

6. Silver bellies.

The landings of silver bellies showed a decline of about 9,000 tonnes during 1977 as compared to 1976 (Table 2). While the States of Andhra Pradesh (1st quarter) and Kerala (IIIrd quarter) recorded higher landings of silver bellies, Tamil Nadu (IIIrd & IVth quarters), Pondicherry (1st quarter), Karnataka (1st & IVth quarters) and Goa (IInd quarter) registered poor landings.

7. Pomfrets.

A decrease to the tune of about 11,000 tonnes was noticed in the landings of pomfrets during 1977 as compared to 1976 (Table 2). While the pomfret fishery was successful in the States of Kerala (IIIrd & IVth quarters) and Gujarat (IInd & IVth quarters) a poor fishery was witnessed in the States of Orissa (IVth quarter), Andhra Pradesh (IInd & IIIrd quarters) and Maharashtra (IInd & IVth quarters).

8. Lobsters.

A minor decline of about 1,500 tonnes in the landings of lobsters was seen during 1977 as compared to 1976. This was mainly due to poor fishery in the States of Tamil Nadu, Pondicherry, Karnataka, Maharashtra and Gujarat. Kerala and Goa, however, recorded comparatively higher landings during the year.

9. Other crustaceans.

The landings of other crustaceans marginally declined by 1,400 tonnes. While Orissa, Tamil Nadu, Pondicherry and Goa recorded poor landings of other crustaceans, Andhra Pradesh Kerala, Karnataka, Maharashtra and Gujarat recorded higher yield.

Frame Survey (FSS/FRA/FS 1.2)

M.S.Prabhu, M.Dharma Reddy, S.K. Dharmaraja, Varghese Philipose, K. Narayana Kurup, K. Balan, Varghese Jacob and K.C.Yohannan.

Excepting in some parts of Goa and Gujarat the frame survey work was completed in all the maritime States of India during 1977. Table III gives the details of fishermen population and fishing boats, in the various maritime States.

Effect of Cyclone.

A series of cyclones along the east coast during the month of November, 1977 brought about complete stoppage of fishing operations in Krishna Dist. (Andhra Pradesh) and Tanjore Dist. (Tamil Nadu). There were considerable loss of life among the fisherman population and also damage to fishing crafts and gears. Resumption of normal fishing operations took several weeks.

Table 3

Catch details of Exploratory Fishery Project vessels during 1977 (In kg.)

upto 40 m depth

Name of Base	prawns	Elasmo-branchs	perches	catfish	others	Total
1.Bombay	178	18703	-	22199	70298	111378
2.Goa	335	12728	15253	33523	103447	165286
3.Mangalore	165	918	-	11887	52515	65485
4.Cochin	694	51199	61043	134884	1067299	1315119
5.Tuticorin	10	28649	54902	-	145690	229251
6.Madras	41	6684	-	-	76366	83091
7.Vishakapatnam	311	3183	-	17815	109910	131219
8.Calcutta	4612	10488	-	13129	47523	75752
9.Port Blair	-	-	-	-	-	-

Beyond 40 m depth

1.Bombay	2	3330	-	-	28460	31792
2.Goa	-	-	-	-	-	-
3.Mangalore	-	-	-	-	-	-
4.Cochin	90	7131	7281	15783	45984	76269
5.Tuticorin	-	-	-	-	-	-
6.Madras	-	-	-	-	11663	11663
7.Vishakapatnam	-	-	-	-	-	-
8.Calcutta	49	1020	-	8706	16926	26701
9.Port Blair	-	12213	-	-	21096	33309

Stock assessment and estimation of potential yield of commercially important fishes (FSS/FRA/FS.1.3)

M.S.Prabhu, Dilipkumar Gosh, S.K.Dharmaraja, K. Narayana Kurup, K. Balan, B.Prasannakumari, K. Vijayalakshmi.

Data on length measurement of samples of commercially important fishes viz. oil sardine, mackerel, Bombay duck and penaeid prawns were collected. The data were analysed gearwise and the mean sizes of the above fishes during the different fishing seasons were calculated. The data are being used for the stock assessment of the above fisheries.

National Fishery Data Centre. (FSS/FRA/ST 1.1)

M.S.Prabhu, M.G.Dayanandan, C.R.Shanmughavelu, S.K. Dharmaraja, Varghese Philipose, K.Narayana Kurup, U.K. Satyavan, K. Balan, K.Nandakumaran, G.Balakrishnan.

The ADP system has been put into operation after proper coding has developed for the fishing data collected and received by this Institute. Cards are punched and action has been taken to analyse the same at the computor centre, Cochin Shipyard Ltd. The processed data are supplied to all national agencies such as State Governments, Central Government and fishing industry and international agencies such as FAO.

For recording of data collected by bigger fishing vessels. Proforma B has been prepared by this Institute for distribution to Exploratory Fishery's Project, Pelagic Fisheries Project etc. so as to receive data from these agencies in the prescribed format for better analysis.

FISHERY BIOLOGY DIVISION

During the year under report detailed Investigations on the Fishery and biological characteristics of the fish resources which support commercially important fisheries were conducted under 24 research projects. Of these, 15 projects, related to pelagic fisheries, 5 to demersal fisheries, 1 to other fisheries, 2 to mariculture and 1 to National Programme of tagging Oil sardine, mackerel and prawns. Three projects on "The present status of the oil sardine fishery", "the present status of the mackerel fishery," and "the status report on the fisheries for Tunas and related species" were completed. The following are the salient features of the work carried out under the division.

Oil sardine production in 1977 was lower by 13% over that of previous year. This decrease was reflected along the coasts of Kerala and Karnataka, the main region of oil sardine fishery. This fluctuation may be attributed to the unsuccessful spawning and recruitment to the fishery; whereas the purse seine fishery conducted outside the traditional grounds of Mangalore and Karwar yielded good catches.

The fishery for lesser sardines and anchovies also showed declining trend during the year. The fisheries, as usual, were supported by 0-year class. The coastal belt between Cape Comorin and Quilon has been found to be the most productive region for anchovies. There is a possibility of increasing the anchovy catch between Quilon and Ratnagiri by extending fishing operations to offshore waters.

The mackerel fishery, during this year showed a marginal decrease during 1977 as compared to 1976. The recruitment of young fish started earlier in the southern region than at the northern centres on the west coast. The landings of mackerel along the east coast was 50% less than that of 1976. The one-year old fish dominated the catch along the west coast, except in southern observation centre where 0-year class predominated. A review of the fishery for the past several years indicated that the annual potential yield was around 1,27,500 tonnes of which the fishery on an average yielded about 70,000 tonnes annually. The catch per unit area appears to be higher off Karnataka and Maharashtra than off Kerala. Inspite of continuous exploitation of this species over the past several decades there seems to be no change in overall size composition of the catches. Increased production is possible by the

introduction of purse seining and extending the operations to deeper areas especially during April to September off season as well during the Peak season.

Intensive observations on the resources of tunas and related species along the west coast have shown that centres like Mangalore and Calicut are also important for tuna and bill fish catches.

Although the 1977 production of Bombay duck fishery was less than that of 1976 there was a considerable improvement in the fishery at Versova as a result of increased fishing pressure and of decrease at Nawabunder, Jaffrabad and Rajpara in Gujarat due to decreased fishing effort. The recruitment of young fish during the year was better than that of previous year. Preliminary studies based on 1976-77 data indicate a survival at rate of 52% for the Bombay duck population.

The scientists of the Institute have actively participated in the Indo-Polish industrial fishery survey conducted off Bombay - Sourashtra Coast. Preliminary analysis of the data showed that the total catch and catch rates were higher by pelagic trawl than by bottom trawls.

Although the all India production of Silverbellies was low in 1977 compared to 1976 season, the fishery from Palk Bay was better during the previous year. The CPUE during the year was also twice higher than that of last year. Studies on the day and night fishing by trawlers indicated that the former operations were 4 times more productive than the night operations.

Studies on the demersal resources during 1977 have indicated that the absence of dara, the relatively poor catches of eel and koth off North West Coast, a significant increase in effort, total catch, catch rate as well as prawn catch off Kakinada and a marked increase in the relative abundance of demersal resources off Waltair are the noteworthy features.

Polyculture experiments conducted with milk fish, mullets and prawns have indicated a satisfactory growth rates(monthly growth rates of 50 mm, 18 mm and 30 mm respectively) during a period of six months. Fish seed surveys of Rameswaram Island, Pamban and Mandapam areas indicated potential elver seed grounds for large scale exploitation

The fishery and resources characteristics of Oil sardine (FB/MF/1.1)

M.H. Dhulked, V. Balan, G. Annigeri, N. Gopinatha Menon, R. Reghu

Salient findings:

The production of the Oil Sardine Fishery during 1977 was estimated 147,073* tonnes, showing a decrease of about 13% over the last years catch. This decrease was reflected in the catches all along the west coast, especially so in Kerala and Karnataka coasts, the main centres of oil sardine fishery. It was seen that the production during the current season was lower by 9,800 tonnes in Kerala and 10,300 tonnes in Karnataka compared to 1976. The yield from the fishery at the northern observation centres Ullal, Baikampady and Karwar followed the same decreased trend off Karnataka; at the Southern centres such as Quilandy, Calicut and Cochin, the estimated catches showed a marginal increase unlike the decreased trend in production in Kerala. One of the important features was the successful development of the purse seine fishery for the oil sardine at Mangalore and Karwar Zones. The purse seine fishery at Mangalore was estimated to have caught as high as 1939 tonnes, in 1977. The breeding appears to have been delayed in 1977 and the recruitment of juveniles was observed during the period September-December along the coast. Recruitment of Juveniles appears to be better at the northern centres than at southern centres. Comparative study on the relative abundance of 0-year class between 1976 and 1977 indicated that the level of abundance of this group in 1977 fishery was low compared to 1976. This may indicate a lower level of production in the following season.

Progress of work:

Monitoring of the fishery and biological characteristics of the oil sardine resource was done at the important observation centres on the west coast.

The fishery at Karwar during the year was estimated to yield 96 tonnes which is about $\frac{1}{4}$ of the last year's catch. Maximum landing was recorded in March. Of the gear employed in the traditional fishery,

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* Provisional

the beach seine, "rampan" obtained the maximum catch (66 tonnes) and catch rate (318 Kgs). Purse seine fishery in September was estimated to land about 8 tonnes of oil sardine of 0-year class (mode 80-90mm). The bulk of the "rampan" and "yendi" catches were contributed by the modal sizes 180-185 mm and by 105 mm and 125 mm respectively. Fishes in advanced stages of maturity were recorded during May-September. Recruitment of young fish (mode 80-90 mm) was observed in September.

A similar trend in the fishery was observed both at Baikampady and Ullal Centres at Mangalore. The production of oil sardine fishery in 1977 by the indigenous gear at Baikampady and Ullal with an estimated catch of 198 tonnes and 49 tonnes respectively showed considerable decrease over the previous years catch of 408 and 155 tonnes recorded at these two centres. Highest catches were obtained during the first quarter at Baikampady and fourth quarter at Ullal. The maximum catch and catch rates were obtained by the "rampan" at the former and the gill net (chalabala) at the latter centre. A significant feature was the development of a successful purse seine fishery for the Oil sardine in the Mangalore Zone. During the year an estimated 1939 tonnes of the species was caught by the purse seine fishery at Mangalore. The bulk of the landings by the traditional gear was composed of fish with modal sizes at 80-90, 135-140 and 170-180 mm, representing 0-year, 1-year and 2-year, classes. The purse seine catches were contributed mainly by the size groups 70-90 mm and 125-150 mm. Fishes with ripe, partially spent and spent condition were observed in the catches from May to October. Recruitment of Juvenile fish with modal sizes at 70-90 mm to the fishery was recorded during August-December period and the interesting feature was their continued occurrence till the end of December. A marginal increase in the yield of the fishery at the southern centres Quilandy, Vellayil (Calicut) and Cochin was recorded. The estimated catch of oil sardine at Quilandy was 5832 tonnes in 1977 as against 5220 tonnes in 1976. The highest catch was obtained in October. Maximum catch (5035 tonnes) and catch rate (379 Kg) were given by pattenkolli. The landings were mainly supported by the modal size of 75-95, 125-150 and 175-180 mm representing 0-year, 1-year and two year classes. In general, mature and spent fishes were abundant during May-September period. The Juvenile fish with modal sizes 75-95 were abundant in the catches during October-November period. The fishery at Calicut (Vellayil) yielded 4214 tonnes in 1977 as against 4009 tonnes during last year. Peak landings were recorded in

July (729 tonnes) and in October (622 tonnes) contributed mainly by 160-/were 180 mm, and 125, 160-170 and 190 mm size groups respectively. The bulk of the seasons catch (80%) was obtained by Pattenkolli with a catch rate of 320 Kgs. Juvenile fish of 90 mm and below were not much in evidence in the catches at Calicut. Scale studies to determine the age structure of the oil sardine population in 1977 were continued.

The Sardine fishery at Cochin was estimated to yield 3575 tonnes which is about 190 tonnes higher than the previousyears catch. Peak catches were recorded during August (549 tonnes) and December (760 tonnes). Of the gears employed Thanguvala obtained the maximum catch (3204 tonnes) and catch rate (552 kg). The fishery was mainly composed of 1-year old fish than the usual 0-year. During current year the former contributed to 58% and the later only to 29% of the catch. In 1976, 0-year class was found to contribute as high as 82% of the catch. Fishes with advanced stages of maturity and in spent condition were recorded mainly during May-September period. The Juvenile recruits entered the fishery only in September, later than the usual period of July.

Work Contemplated:

Studies on the fishery and resources characteristics of the oil sardine will be continued on the above lines at all the main centres.

Unit stocks of oil sardine (FB/MF/1.2)

M.H. Dhulked, S.G. Annigeri, N. Gopinatha Menon and R. Reghu.

Salient findings

Studies on the variations in vertebral countsof oil sardine at Karwar, Mangalore, Calicut and Cochin have shown that the majority of individuals have vertebral counts 46 and 47 from all centres examined.

Work done

Investigations on the variations in vertebral counts of the species to identify the unit stocks, if any, have progressed well in all the Centres during the period. In general the number of vertebrae was found to vary from 45 to 48 with maximum number of fish having 46-47 counts. The mean vertebral count, however, appears to be higher in the samples examined at Karwar, Mangalore and Cochin than at Calicut.

Work contemplated:

Observations will be carried out in greater detail on the problem.

Evaluation of resources of Lesser sardines, anchovies and other clupeoids (FB/MF/1.3)

G. Luther, P. Sam Bennet, S. Lazarus, R. Thiagarajan, C. Muthaiah, P. Radhakrishnan Nair, J.C. Gnanamuthu.

Salient findings

The fishery for lesser sardines in 1977 showed a downward trend at Tuticorin and Vizhinjam, but yielded better catches at Mandapam, compared with last year. Similar decline in the catches of anchovies was also observed at all the observation centres.

Work done

Lesser sardines

The lesser sardine catch at Vizhinjam was 126 tonnes which is about half the quantity landed last year. Gill nets brought the bulk (78.3%) of the catch. Sardinella gibbosa and S. sirm, in about equal proportion, have accounted for 85.8% of the sardine catch. Peak landings were recorded during May-June and October for S.gibbosa; and during February-March and November-December for S.sirm. The fishery at Tuticorin was not good this year with an estimated landing of 1993 tonnes, as compared with 2529 tonnes recorded last year. There appears to be a gradual decline in the lesser sardine catch from 1975. Gill nets landed all the sardine catch. Highest catch was recorded in December and lowest in May. Sardinella gibbosa and S. sirm mainly supported the fishery with an estimated catch of 1231 and 354 tonnes respectively. The landings of lesser sardines at Mandapam during the year were about four times higher than last year's catch. About 405 and 120 tonnes were landed from Palk Bay and Gulf of Mannar respectively and mainly by shore seines and gill nets. The Peak fishing season was April-July in Palk Bay and April-June in the Gulf of Mannar. S.gibbosa in the former and S.albella in the latter areas were the predominant species. A total 110 tonnes of lesser sardines was estimated to land at Madras mainly by gill nets. S.fimbriata, S.gibbosa and S.dayi were the predominant species. In all the centres the fishery was mainly sustained by 0-year and 1-year old fish.

Anchovies

The fishery at Vizhinjam was poor this year compared to previous year. A total of 98 tonnes of anchovies was landed during the year as compared with 174 tonnes during last year. This fall in catch was attributed to the poor landings during September-October, the main anchovy season and to the poor recruitment of young fish during January to June. Boat seines, shore seines and gill nets were the main gear employed in the fishery. The fishery was supported mainly by Stolephorus devise (30.5%), S.bataviensis (29.8%) and S.buccaneeri (37.9%). A total of 3 tonnes of anchovies was landed by shore seines at Panaikulam near Mandapam. Predominant species were S.devisi(44.5%), S.bataviensis (40.5%) and S.indicus (13.1%). The fishing season was from January to August. At both the centres the fishery predominated by 0-year class with respect to all species.

Studies on culture of anchovy for live bait purpose have shown very high initial mortality for all species of anchovies. Thereafter, it was fairly low. S.buccaneeri was found to be relatively hardier than the other species.

Other clupeoids

These were investigated at Bombay Centre. The estimated landings of other clupeoids during 1977 were 420 and 251 tonnes at Sassoon dock and Versova respectively. Trawl and 'Dol' nets were the main gears used. Coilia dussumieri was the dominant species among the other clupeoids accounting for 95% in trawl catches and 54% in 'dol' net catches landed at Sassoon dock and 78% in 'dol' net catches at Versova. Recruitment of juveniles of the dominant species, ranging in length from 15 mm to 110 mm took place during March-July period. Adult fish with advanced stages of maturity were recorded during January-March and in July. Growth studies showed a monthly growth of 10 mm at 60-90 mm size, 5 mm at 110-139 mm size and 3.3 mm at 150-159 mm size.

Work contemplated

Studies on the resource characteristics and biological characteristics will be monitored at the existing centres and will be extended to other centres. Marking experiments will be conducted in Palk Bay on S.gibbosa and S.albella to find out whether these fish would migrate to Gulf of Mannar for spawning. Problems connected with capture, handling and transport of anchovies in live condition and stocking them in cages in the sea for longer periods will be investigated to use them as the live bait in tuna fishing.

Oil Sardine fishery Atlas (FB/MF/1.4)

P. Vijayaraghavan, Varughese Philipose, R. Reghu.

Landing data of all the maritime states of India have been compiled and classified into suitable form. Data on the distribution of eggs, juveniles, maturity and spawning pattern, life history and food has been compiled. Information on the biological aspects of the species in relation to the environmental factors influencing them is being collected.

The present status of the Oil sardine fishery (FB/MF/1.5)

P. Vijayaraghavan, M.H. Dhulked, V. Balan, Varughese Philippose, G.G. Annigeri, N. Gopinatha Menon and R. Reghu

A detailed report on the status of the fishery of oil sardine for 25 years upto 1977 is nearing completion. Based on the preliminary analysis of the data on recruitment during the latter half of 1976, compared to 1975, along Kerala (Calicut - Cochin) coast, it was predicted that off Kerala the oil sardine catches are likely to be higher in the first half of 1977 than it were in 1976. This has come true; the landings of Kerala being 32, 109 and 4576 tonnes respectively during the first half of 1977 and 1976. In the Karnataka Coast recruitment during the second half of 1976 was lesser and the prediction that landings in that region may be lesser in the first half of 1977 compared to the same period in 1976 has also been realised; the respective catches being 6,472 and 4,812 tonnes.

The comparative intensity of recruitment at different centres of observation during 1976 and 1977 indicates that the level of recruitment during the current year appears to be several times lower than that in 1976. It may hence be expected that the Oil sardine fishery in 1978 may be much less productive than in 1977.

The present status of the fishery of anchovies (FB/MF/1.6)

G. Luther, P. Vijayaraghavan, V. Ramamohana Rao, M.M. Meiyappan and R. Reghu.

Salient findings:

The coastal belt between Cape Comorin and Quilon is the most productive region for anchovies. There is a possibility of increasing the anchovy catch between Quilon/Ratnagiri by fishing in offshore waters.

Work done:

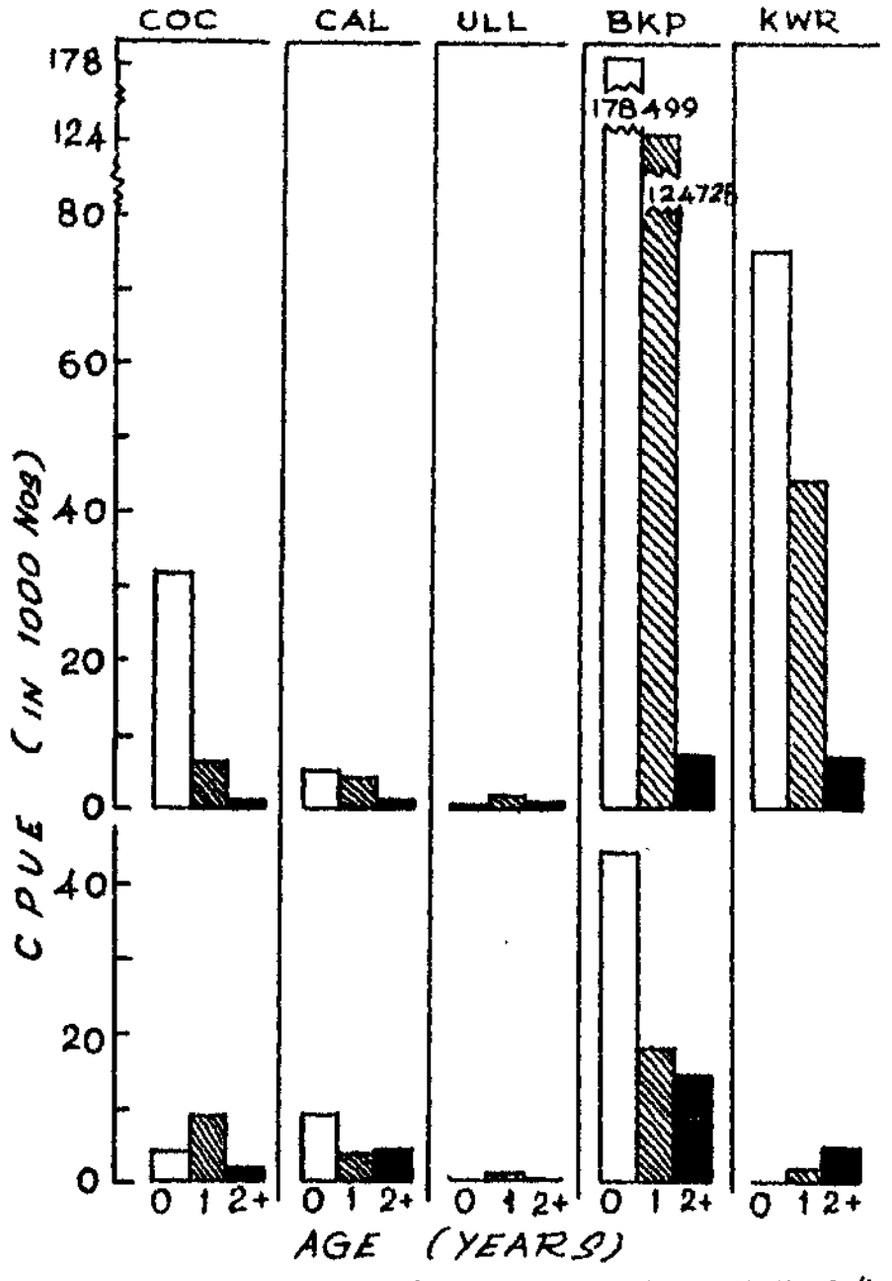
The monthly anchovy fishing data from eleven fishing survey zones along the southwest coast of India between Cape Comorin and northern boundary of Kerala coast was analysed and studied.

The region between Cape Comorin and Quilon was found to be the most productive for anchovies, landing annually a little over 10,000 tonnes, forming 70% of the anchovy catch landed along the southwest coast. Stolephorus devisi and S.bataviensis are the commercially important species in the region. There are two fishery seasons in the southern region, one during January-May and the other during September-November. There is a possibility of increasing the anchovy catch between Quilon and Ratnagiri by fishing in the offshore region.

Fishery and biological characteristics of anchovies of Vizhinjam area have been studied. As the fishery is mainly supported by the 0-year class anchovies are to be regarded as annually renewable fishery resource. The species spawn over an extended period and have multiple spawnings in a year. The 'Nonnavu' fishery which takes a great toll of the young ones of Stolephorus spp. and its impact on large-sized anchovy fishery deserve detailed studies.

Work contemplated:

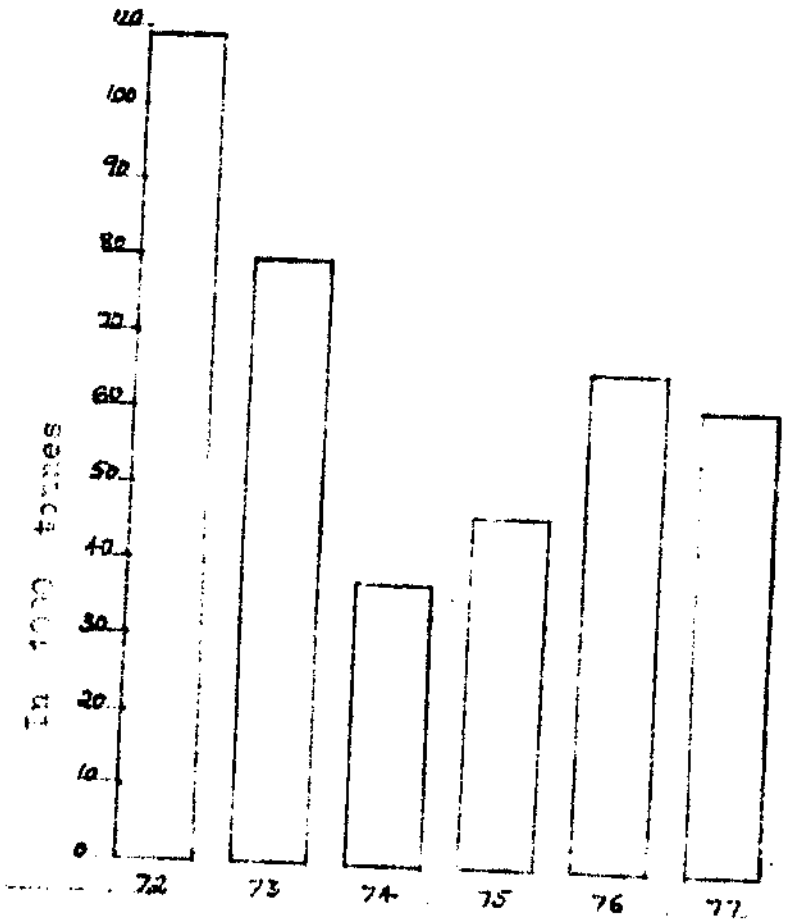
The project will be continued during 1978 also. The available anchovy catch data will be analysed and brought upto-date to assess the distribution pattern of the anchovies in time and space. Besides this, information as the biological aspects of anchovies will be consolidated and a report on the status of the anchovy fishery resources of the Indian region will be prepared.



COC - Cochin (Thanguvala) CAL - Calicut (Pattenkollivala)
ULL - Ullal (Chalabale) BKP - Baikampady (Rampan)
KWR - Karwar (Rampan)

The age composition in the catch per unit effort of Oil sardine at different centres

Fig. 1



Gradient of mineral deposition [illegible].

Investigations on mackerel fishery resources (FB/MF/2)

G. Seshappa, A. Noble, M.V. Pai, V. Balakrishnan, N.S.Radhakrishnan, R.S. Lal Mohan, T.M. Yohannan, A.A. Jayaprakash, P. Nammalvar, K. Rajasekharan Nair.

Salient findings

The fishery remained almost at the same level as that in the previous year and as usual the recruitment started earlier in the south than the north along the west coast. The landings along the east coast were just half that of last year [illegible]. The one-year old fish dominated the catches along the west coast except the southern point where 0-year olds dominated.

Progress of work

The mackerel landings in the country in 1977, stood almost at the same level as in 1976,; the respective figures for the two years being 61213 tonnes (provisional) and 65497 tonnes (Fig.1). The catch along the east coast this year was just half that of the previous year (Fig.2). Along the west coast, the catch in Maharashtra was only less than half but in Kerala the reduction was just a little. On the contrary, in Karnataka and Goa the catch improved slightly and in Andamans there was 50% increase.

Excepting a small decline at Vizhinjam, the cpue (Table 5) along the west coast improved a lot and at Cochin it was considerably high. The distribution of year classes in the commercial catches indicate that the fishery in 1977 depended on 1-year old fish along the coast except at Vizhinjam where the 0-year old dominated.

As usual the 1976 season continued to contribute to the catches in the Ist half of 1977 also. The recruitment in 1977 commenced in May in the south (Vizhinjam) and later in the northern centres of the west coast.

An interesting phenomenon observed in this year was the occurrence of large quantities of mackerel in the shrimp trawls along the coast; and at Calicut where 8600 trawlers operated, the cpue is calculated to be 58 numbers of fish weighing 5.8 kg. At Mangalore, the purse-seiners landed heavy catches of commercial sized mackerel in October and November.

Investigations on the unit stocks (FB/MF/2.2) of mackerel were continued. The variations in the characters of length from snout to anal and from snout to orbit and depth and thickness appeared significant. Mackerel with haemal braces from 14th vertebrae onwards dominated the catches at certain time of the year, perhaps indicating the presence of a sub-population.

The work on the mackerel fishery atlas (FB/MF/2.3) is in progress. Figures depicting the distribution of the adults, juveniles and larvae were drawn and charts of landings in relation to environmental parameteres were also provisionally made.

A detailed final report on the present status of the mackerel fishery (FB/MF/2.4) is submitted; and it deals with the distribution and bionomics of the mackerel, its growth, fishing grounds, gears used, all-India catch, state-wise catch, landings in relation to other fisheries, seasons, fishing in relation to environmental factors, size, mortality, recruitment, migration, unit stock, stock assessment, and prospects in the coming years; and the most salient features are briefly summarised as follows.

The Indian mackerel is widely distributed in the tropical and central Indo-West Pacific but the highest catches occur in India. Distribution of larvae and juveniles also have been noted, but no concentration of spawning fish or large quantities of eggs and larvae were noticed at any time of the year so far. The mackerel form distinct schools only from the size of 100 mm onwards. The fish remain in the shelf waters throughout the year, but are abundant mostly in waters shallower than 30 m.

The bulk of the catch in the country come from the region between Quilon and Ratnagiri on the west coast. The fish is at present exploited only from the coastal waters with indigenous crafts and gears. The annual average catch is roughly 70,000 tonnes, varying from year to year between 16,431 tonnes of 1956 and 204,575 tonnes of 1971. The mackerel forms 8% of the country's marine fish production.

Though the catch is the highest in Kerala, the catch per km coast and the catch per km^2 seems to be very high in Karnataka and Goa. In the case of catch per km^2 even Maharashtra seems to have a higher turn-over than that of Kerala. It will be apparent from these that the variation in the mackerel catch of the different states is not related to the extent of fishing grounds each state has, but depends upon the availability of the fish and the density of their occurrence in the coastal fishing belt. In relation to other fisheries the mackerel is not the most important in Kerala, whereas it is of high commercial importance in Karnataka and especially Goa.

From the studies on the size distribution of the commercial catches for the last 42 years it is apparent that inspite of the increased exploitation that has been taking place in the recent past, there has practically been no major change in the overall size composition of the catches, the approximate prevailing commercial sizes or the mean sizes of the fish, though variations within the overall limits from time to time and place to place are prevalent. The fishery at Vizhinjam comprises mostly of 0-year olds (below 155 mm) and at other places 1-year olds (160-225 mm) which is the commercial size; and it depends on the survival rate and the shoreward movement of the fish in a year. The survival rate of the mackerel during 1970-76 period for the west coast where the instantaneous mortality is calculated to be 2.877 works out to be about 6%, indicating the death of most of the fish in the sea and the absence or negligent occurrence of old fish in the commercial catches. The stock assessments made by the acoustic and aerial surveys of PFP and from the catch data by the scientists of CMFRI average to be around 127,500 tonnes. The average annual production of the mackerel in the country during 1950-1976 is only around 70,000 tonnes and about 57,000 tonnes from the potential yield remains still untapped in the sea, and attempts should be made to catch them by expanding the effort in time and space wherever they are feasible.

Studies conducted so far show that the mackerel shoals are confined mainly to the 15 km coastal belt during October-April period which is the main season for it. This belt is almost fully exploited in Kerala but not so in Karnataka and Konkan coasts; and according to our scientists we are almost exerting the maximum fishing effort and are nearer to the optimum yield, and further increase in the fishing effort in the area already exploited at present may fetch only marginal increase in the catch; and the balance of advantage in the immediate future, therefore, appears to lie in taking steps to extend the fishing operations at least upto 15 km offshore in the coming few years during October-March period and also in the extension of the fishing activities during the April-September period, its impact on the standing stock being closely watched.

Electrophoretic studies on the eye lens proteins showed heterogenity of the mackerel population and the analyses of the serum proteins and isoagglutinin tests of erythrocytes revealed the existence of genetically different groups in the south-west coast of India. The finding that before the commencement of the season along the west coast the shoals are confined mainly to the region between Ponnani and Mangalore support the south to north migration of the shoals during the season. Whether the shoals occurring south of Cochin form part of this stock has to be elucidated in future studies.

Similarly identity of the Gulf of Mannar stock and its relation to the stock off Ceylon and Vizhinjam are also subjects which should receive urgent consideration.

Work contemplated

Investigations on the fishery and biology of the mackerel in time and space such as the age and rate of growth, maturity and breeding, recruitment and mortality, migration and exploitation, and catch and abundance to be continued. Preparation of the mackerel atlas to be carried on and the probe on the unit stock to be continued.

Table - 5

The cpue in numbers of the mackerel of different age groups at important centres of observations in the second half of 1976 and 1977.

Centre and gear	cpue of different age groups							
	1976				1977			
	0	1	2	3	0	1	2	3
(1)	61	13	0	0	47	14	+	0
(2)	24	168	1	0	58	591	0	0
(3)	420	363	14	0	25	1537	120	0
(4)	0	1201	108	0	0	3184	0	0
(5)	100	26415	1151	0	0	54021	0	0

(1) Vizhinjam (boat seine)
(2) Cochin (boat seine)
(3) Calicut (boat seine)
(4) Ullal (Pattabala)
(5) Baikampady (Rampan)

Resources of tunas and related fishes (FB/MF/3.1)

E.G. Silas, M.D.K. Kuthalingam, M.S. Rajagopalan, V. Balan, M. Devarajan, I. David Raj, Pon Siraimeetan, P. Livingston and others

The fishery and biology of tunas and billfishes were observed from Mangalore, Calicut, Minicoy, Cochin, Vizhinjam and Tuticorin.

Mangalore:

The tuna catch for the period July to December was estimated as 105.4 tonnes from drift gill net units employing 60-165 mm mesh types. The total effort was 12634 boat days and the cpue for tunas was calculated as 8.341 kg. The dominant species in the catch was Euthynnus affinis forming 90.35%. The peak period of occurrence was October. The sizes of E. affinis ranged from 210-850 mm with five modal sizes. Thunnus tonggol ranged from 410 to 850 mm. The food of juvenile E. Affinis consisted mainly of Aceteg and that of adults chiefly Stolephorus. In the case of T.tonggol, cuttlefishes, silver bellies and anchovies formed the important food items.

26 tonnes of billfishes landed in the Mangalore area from the same gear employed for tunas and for the same effort, the cpue for billfishes was 2.06 kg. The sailfish, Istiophorus platypterus ranging in length from 1475 to 1875 mm formed about 79% of the catch and the rest by marlins (Makaira tenuirostratus) with size range 1675 to 2375 mm. The food of sailfishes comprised of carangids, Lactarius, Anchovies and cuttlefishes.

Calicut

Tuna catches were mainly from drift net operations in depth zone 35-55 metres. Though E.affinis formed the bulk of the catch during the year, T.tonggol, N. Macropterus Sarda orientalis, Auxis thazard and Katsuwonus pelamis also yielded small quantitites. The modal size range of different species was as follows:

E. affinis	450 to 650 mm
T. tonggol	450 to 700 mm
N. macropterus	650 to 700 mm
S. orientalis	200 to 300 mm
A. thazard	200 to 250 mm
K. Pelamis	450 mm

The landings of billfishes at Calicut improved considerably during the year with an estimated catch of 31.05 tonnes as compared to a meagre 800 kg during 1976. The modal size of sailfishes ranged from 1550 to 20000 mm. The catch of marlins comprising (M.indica and M. nigricans) amounted to 5.1 tonnes during the year and the sizes of these fishes were above 2000 mm.

Cochin

The All India total catch of tunas was provisionally estimated as 12,936 tonnes as against 19,322 tonnes during 1976 showing a decline of about 37%. About 50% of this catch was contributed by Kerala. The state-wise estimate of tuna catches are as follows:

Orissa	-	37	Goa	107
Andhra	-	449	Maharashtra	249
Tamilnadu	-	3237	Gujarat	223
Kerala	-	6684	Andamans	37
Karnataka	-	622	Lakshdweep	1291

(Catch in tonnes)

At Cochin, observations were made on the tuna landings from the IFP and PFP vessels. The catch during the year from 'Samudra Devi, Norind, M. boats and other vessels amounted to approximately to 22.9 tonnes. Tuna catches were mainly from purse seine operations in the areas off Cochin (9-76, 10-76, 11-75, 12-74). Maximum tuna catch occurred during February to May and no catch during the second half of the year. E. affinis formed the bulk of the catches.

Vizhinjam

An estimated catch of 41.6 of tunas landed during the year forming about 15% total fish landings at Vizhinjam. Drift nets and Hooks and lines landed 92% and 5.6% of the catch respectively.

E. affinis formed 53% of the catch and A. thazard 43%. The size range of E.affinis was 320-700 mm, and that of A.thazard between 300-459 mm.

Tuticorin

Tuna landings were in appreciable quantities during the third quarter when compared to the other periods of the year. The catches were mainly from drift nets, troll lines and sardine gill nets. The size range of different species were: E. affinis-175-700 mm; A. thazard 310-470 mm; S. orientalis-144-200 mm

Stray catches of the sailfish, I. Platypterus occurred during January, April, August and November. The dominant size group was 2000-25000 mm.

Minicoy

The estimated tuna catch in the Lakshadweep islands was 1291 tonnes. Investigations on the biology of K. pelamis and other tunas were continued. Tilapia has been cultured in experimental ponds with success and this could form an alternate source of bait fishes for tuna live bait fishery in the island.

Status report on the fisheries for tunas (PB/MF/3.2)

E.G. Silas, M.S. Rajagopalan

Consolidation of the data on the tuna fisheries in the country is nearing completion. The status report which is being written up will include information on catch and effort, fishing grounds, species distribution, biological aspects and stock assessment.

Tuna catches in the country has been steadily increasing during the past few years. 50% of the catch comes from fishing operations along the Kerala coast and 25% from Tamil Nadu. Systematic observation made on the tuna fishery at Calicut and Mangalore has revealed that these centres are equally important for tuna catches.

Resources of seerfishes (FB/MF/3.3)

M.V. Pai, M. Devaraj, T.M. Yohannan and K. Srinivasa Rao

Salient findings

Morphometric comparisons of samples of juveniles of Scomberomorus guttatus from five localities showed that highly significant differences are due to regression coefficients as well as adjusted means for all characters. Character by character comparisons of the means of morphometric characters of the different samples show that the Kakinada and Bombay samples share certain common features compared to the Waltair samples. The Kakinada samples are the farthest removed from the Waltair Bimili complex with Madras and Bombay occupying an intermediate position. The extreme variations in the samples from Kakinada may be attributed to the typically estuarine conditions in the locality.

Evaluation of the resources of Bombay duck and Lizzard fishes (FB/MF/4.1)

S.V. Bapat, A.S. Kaikini, A. Kurian, M.Z.Khan and S. Basheeruddin.

Salient findings

The fishery for Bombay duck during the year was considerably of lesser magnitude than that of last year. The estimated catch at Versova in 1977 was almost double that of 1976 as a result of increased fishing pressure, while at the three observation centres at Nawabunder, Jaffrabad and Rajpara in Gujarat a decrease in catch over last year was observed as a consequence of decreased fishing effort. The recruitment of young fish during the year was better than last year. Preliminary studies, based on 1976-77 data, indicate a mean survival rate of 52% and the total mortality of 48% for the Bombay duck population. The fishery for lizard fishes at Madras was poor during the year.

Work done:

Bombay duck.

The Bombay duck landings in India in 1977 was estimated at 62,404 tonnes showing a sharp decline of 28% from the landings of previous year; while there was a decline of about 16,000 tonnes in the catches of Maharashtra coast; a short fall of 7,902 tonnes was observed in Gujarat as compared with that of last year. The Bombay duck landings at Versova in 1977 were almost double that of 1976 with a similar increase in fishing effort. The landirgs were very encouraging in January but this trend of good catches was not maintained in the subsequent premonsoon months. The fishery commenced very well in October but proved to be failure in November and December due to rough weather conditions. The fishery in general was also at a low ebb at Arnala after the monsoon. The proportion of juvenile varied from about 55 to 95% in the catches. The average size of the species has shown an increase with 178 compared with last years size of 164 mm.

The fishery during the year at the three observation centres at Jaffrabad, Rajpara and Nawabunder in Gujarat was of lower magnitude with an estimated catch of 33,758 tonnes as compared with 35,000 tonnes landed in 1976. The fishing effort was similarly lesser than last year. Juveniles of 30-90 mm size constituted to 85-90% of the catch. A good recruitment of young fish was observed during February-March and October-November periods. The average size during the year was 107 mm as compared with 139 mm in 1976. Spawners were observed in the catches during December.

Mature and ripe ovaries of Bombay duck from different size groups were analysed for their biochemical constituents. The results showed that the ova from fish of 245-265 mm length group had the highest (1.5%) lipid content.

Lizard fishes

Studies on the fishery and biology of lizard fishes, based on the data and material collected from the exploratory fishing vessels operating from Madras base were continued. The catches, mainly contributed by Saurida undosquamis, were poor with an estimated 742 kg. during the year. Almost 90% of this catch was landed during April-May. The predominant size during these months varied from 130 to 180 mm.

Work contemplated

Studies on the evaluation of the resources of Bombay duck and lizard fishes will be continued.

Unit stock of Bombay duck (FB/MF/4.2)

S.V.Bapat, V.M.Deshmukh, M.K. George and A. Kurien.

Salient findings

Studies on morphometric characters in respect of samples from Dahanu indicated that the characters were non-significant.

Electrophoretic studies on the enzymes and myogenes of Bombay duck indicated that the fishery off Maharashtra is supported by a homogenous population.

Progress of work

The morphometric characters such as standard length vs depth of caudal peduncle, depth through anal, depth through first dorsal, length of lower jaw, length of head were analysed in respect of two samples from Dahanu were found to be non-significant.

Samples of Bombay duck collected from six centres were tested by starch-gel electrophoretic technique to study mainly enzyme in muscle and liver and tetrazolium oxidase enzyme in liver. Distribution patterns of esterase enzyme and Aurido black proteins from three centres of Bombay area were also tested. As these enzymes are non-polymorphic they may not indicate anything about the population structure of Bombay duck. Other enzymes are being tested to find out suitable gene marker. Tests for tissue-wise distributions of the above enzymes indicated some tissue-specific characteristics of lactase dehydrogenase which is present in nine different tissues tested; whereas tetrazolium oxidase could be detected only in the liver.

Lactate dehydrogenase, eye lens proteins and muscle myogenes were analysed by gel electrophoresis, eletrophocussing and cellulose acetate eletrophoresis. The enzyme, LDH from the population showed two, three and five bands and this polymorphism is believed to be non-genetic. Based on this and earlier studies on myogenes, it is believed that the fishery along Maharashtra coast is supported by a homogeneous population. Ready to use polyacrylamide gel plates which can be stored at room temperature were also developed.

Work contemplated.

Work on the above lines will be continued. Electrophoresis studies with reference to population structure will be extended to other commercially important species.

Studies on the resources of catfishes, perches and carangids (FB/DR/1.1)

B. Krishnamoorti, P. Mojumder, V. Sriramachandramoorty,
S.S. Dan, V.S. Rangaswamy, T. Prabakaran Nair and A.V.Srinivasan.

Salient findings

The catfish landings both at Waltair and Mandapam Camp showed improvement during the year compared with that of 1976. The fishery was supported by Tachysurus thalassinus and T. tenuispinis at Waltair and by T. thalassinus and T. dussumieri at Mandapam Camp. The peak period of abundance was during the first and second quarters.

The perch fishery at Kakinada was supported mainly by Nemipterus japonicus which formed 55% of the total nemipterid catch. The landings were supported by 0, 1, 2 age groups.

There was a considerable decline in the carangid catches at Vizhinjam compared to last year. The common species in the landings were Megalaspis cordyla, Decapterus spp. and Alepes mate

Work done

Catfish investigations: Catch and catch per unit of effort, (gear-wise and month-wise) for the dominant species were calculated at Waltair and Mandapam. The maximum abundance was recorded during the first and second quarters. At Waltair biological studies on the dominant species T. thalassinus and T. tenuispinis were under taken. Studies on the otoliths, opercular bones and size frequency data were undertaken to estimate growth, age and yield per recruit of the main species. Similar studies were undertaken at Mandapam on T.thalassinus and T. dussumieri. Perch Investigations: Studies on the fishery and biological characteristics of nemipterids were continued at Kakinada. The catch, catch per-unit-of-effort, seasons of abundance were calculated. Studies on the breeding period, size composition, growth and age of the dominant species were undertaken. During the year an estimated 1041 tonnes of nemipterids were landed by trawlers forming 1.5% of the total catches. The fishery was mainly supported by Nemipterus japonicus which formed 54.5% of the nemipterid catches. Majority of the catches of the dominant species, were comprised of 0, 1, 2, age groups. The species spawns in the area during August-March period.

Another species N. mesoprion occurred in the catches mainly during January-May, Females of this species in ripe condition were observed during January-February months.

Carangid investigations: Catch, effort and catch per unit of effort monthwise, gear-wise were calculated. During the period a total catch of 251 tonnes of carangids was obtained which is less than half of the last year's landings. Carangids contributed to 9% of the total marine fish catch at Vizhinjam. During the year Megalaspis cordyla, Decapterus spp. and Alepes mate formed dominant species in the landings. Biological studies on Megalaspis cordyla were undertaken.

Work contemplated:

Studies on the above lines will be continued and intensified in all the selected centres.

Sciaenid resources of the east and west coast of India (FB/DR/1.2)

T.Tholasilingam, V. Sriramachandra murty, K.V. Somasekharan Nair, R.S. Jadhav.

Salient findings

The total yield of sciaenids at Kakinada with 2699 tonnes registered an over all increase on 33% when compared to the catches of previous year. Maximum production as well as the maximum abundance, were in May. During the year sciaenids formed about 12% of the trawl catches. Although no species contributed to the fishery through out the year; A.nibe, J.vogleri and P.aneus together accounted for 87% of the catch. The first two species appear to breed in the area over a number of months with a peak during February-June period. The bulk of the catches of the predominant species was sustained by the size group 140-179 mm.

The fishery at Calicut showed a sharp decline in 1977 with an estimated catch of 76 tonnes which is about half the landing in 1976. Maximum catch and CPUE were recorded during December-January period. The fishery was mainly supported by J.sina, O.ruber and O.cuvieri. 0-year and 1-year old fish mainly contributed to the catches. Both J.sina and O.ruber spawn over a prolonged period with the possibility of two peaks during a year. Recruitment of young fish was also observed over a number of months. The food consisted of teleosts, prawns, amphipods, sanilla and copepods.

The fishery for Doma or the smaller sciaenid fishes commenced from September. The total landings of Doma at Veraval was estimated at 2541 tonnes. Highest catch was obtained during September. Important species of sciaenids in the catches were O.brunneus, O.argenteus, O.maculatus and P.diacanthus.

Work done

Catch, effort and catch per unit of effort were estimated in all the Centres. Species composition, length frequency distribution, sex-ratio, breeding, food components, age and growth of the commercially important species were studied. Biological characteristics were investigated in detail at Kakinada on A.nibe and J.vogleri; and at Calicut on Johnieops sina, otolithus ruber and Johnius dussumieri.

Work contemplated

Work on the fishery aspects and the biological characteristics will be continued at all the observation centres

Studies on the resources of Silver bellies and ribbon fishes (FB/DR/1.3)

G. Venkataraman, Y. Apparna Sastry, P.T. Meenakshisundaram, J.C. Gnanamuthu, M. Badrudeen.

Salient findings

Silver bellies

The fishery for silver bellies has yielded during the current year an estimated total catch of 34,355 tonnes (Provisional) which is less than that of previous year. However, the landings from the Palk Bay area off Mandapam during the year showed an improvement with an estimated catch of 3602 tonnes as against 2055 tonnes in 1976. The CPUE (catch per boat per day) during the current year was also higher with 156.5 kg. which is twice that of last year.

Studies on the day and night fishing for silver bellies showed that the catches and the catch rates during day operation were four and twenty times higher respectively than that of night fishing; the respective figures in that order being 2889 tonnes, 754.7 kg. and 713 tonnes, 37.2 kg.

The fishery was found to be good in the northern side of the palk bay as evidenced by heavy landings of silver bellies in zone during the year.

The fishery on the Gulk of Mannar side was negligible with a catch of 22 tonnes landed in December by night fishing. The catch per unit of effort was 19.2 kg.

Investigations on silver bellies resources of Rameswaram were initiated in 1977. The catches at this Centre were obtained from the Palk Bay and by night fishing. The annual fishery at this Centre has produced an estimated catch of 4943 tonnes giving a catch rate of 100.5 kg. per night per boat. Maximum catches were

obtained during December & January.

In the landings at Mandapam and Rameswaram Leiognathus jonesi formed the predominant species with an estimated catch of 3089 and 3806 tonnes respectively. Other important species that contributed to the landings at Rameswaram were L.brevirostris and L.dussumieri.

The estimated landings of silver bellies by mechanised boats at Kasimedu (Madras) were 645 mt. during the year and constituted 16.4% of the total landings at the Centre. Compared to last year, the catch during the year was good. Maximum catches and high catch rates were obtained generally during fourth Quarter. Monthly landing varied from 36 to 81 tonnes with an average catch of 53.8 tonnes. In January, July, August, October, November and December the landings exceeded the monthly average catch. Two species Leiognathus bindus and L. dussumieri contributed to the bulk of the catch.

L. Jonesi caught from Palk Bay had modal size range from 30-95mm at Mandapam and 30-110 mm at Rameswaram. The fishery was mainly supported by 0-year and 1-year fish. The studies indicate that the species breeds over a number of months with maximum spawning, during January-April and September-December. Recruitment of young fish (30-40mm) into the fishery took place twice during the year. At Madras the dominant species was L. bindus which had a size range of 40-155 mm with a modal range of 65 to 105 mm. Young fish with modal sizes at 40 mm were recorded only in November. Studies on the maturity condition indicated that a good proportion (40-65%) of the fish, in January, May, June, October and November, was mature.

Ribbon fish

The mechanised trawl fishery at Kasimedu (Madras) has yielded an estimated catch of 175 tonnes during 1977 which is more than twice the production in 1976. The landings were generally good during October - January period with Peak catches and catch rates occurring in December. The main species caught was Trichiurus lepturus.

At Kakinada an estimated 2223 tonnes of ribbon fish were landed forming 9% of the total trawl fish. There was more than two fold increase in the yield of 1977 compared to that of previous year with a catch of 632 tonnes. The catch rate during the current year was also higher with 5.4 kg. per trawling hour as compared with that of 1976. The fishery remained productive through out the year with two peaks of abundance during February-May and August-November. As at Madras, again T.lepturus dominated the trawl catches at Kakinada forming 93% of the total ribbon fish catch. L.savala also contributed to some extent to the catches.

The size of the T.lepturus obtained at Kakinada varied from 17 to 102 cm. with dominant size at 25-40 cm and 64-73 cm. At Madras the dominant size ranged from 25-50 cm. The fishery was sustained mainly by 1 to 3 year classes. Fish in advanced stages of maturity were found during several months.

Work done

Investigations on the fishery and biological characteristics of the resources of silver bellies and ribbon fishes were continued. Catch, catch per unit of effort and species composition were estimated for the resources at the selected centres. Size and age composition and growth of the predominant species under each resource, was investigated.

Work contemplated

Work on the above lines will be continued to monitor the resource characteristics.

Evaluation of demersal resources of some selected areas (FB/DR/1.4)

C. Mukundan, V.M. Deshmukh, M.K. George, C. Muthiah, G.S. Daniel Selvaraj, M.M. Meiyappan, M. Vijayakumar, P. Sam Bennet, M. Devaraj, P. Natarajan, V.S. Rangaswamy, P.T. Meenakshisundaram, R. Sarvesan, M. Rajagopal, Y. Appanna Sastry, W. Venugopalan, B. Krishnamurty, V.Ramamohana Rao, S. Reuben, S.S. Dan, P. Mojumdar, T. Appa Rao, D.B. James and others.

Salient findings

The analysis of the data of the EFP trawlers off Bombay indicated that Meena Bharati obtained better catch (25.3 t.) and catch rate (322 kgs./hr) from the area 17-72 than in other areas. Catfish contributed to the dominant catch. However, the highest catch rate (535 kg./hr) was given by 17-72). That of Meena Samgahak showed that the square 18-72/5D gave the highest catch (4.9t.) but the highest catch rate (208 kg./hr) was given by 17-72/6D. The bulk of the catch was contributed by elasmobranchs (24%), dhoma (16%) and cat fish (14%). The absence of dara and the relatively poor catches of eel and koth are noteworthy. Meena-prapi operated in the areas 17-72 & 18-72 during first quarter and obtained 39.8 tonnes with a catch rate of 171 kg/hr. catfish contributed to 50% of the catch.

Studies on the first four fishing cruises of the Fishery Research Vessel 'Muraena' during the year, off Bombay - Samrashtra coast, revealed that generally the total catch and catch rates were better by the pelagic trawl than by the bottom trawl. The former obtained the highest catch (102t) and catch rate (1480 kg/h) during the second cruise from the depth zone 51-70m. The highest catch (21 t) and catch rate (202 kg/h) from the bottom trawl were obtained during the first Cruise from the depth zone 31-50 m.

The trawling operations of the IFP &EFP vessels at Cochin showed that the maximum catch (160t) and catch rate (223 kg/hr) were obtained by the larger vessel operated during the second quarter.

The highest catch off Tuticorin was from 8-78/43 and the catch rate from 8-77/IF (223 kg/h). Perches and rays formed the dominant elemant in the catches. At Madras EPF vessels obtained about 105 tonnes with a catch rate of 122 kg/hr. Though the catch and effort were slightly lower this year than in the previous year, the catch rate was higher. The highest catch rate (421 kg/hr) was recorded from 14-80/38 in July. Silver bellies and rays were the major constitutents of the trawl landings.

At Kakinada there was a significant increase in effort, total catch as well as prawn catch. An estimated catch of about 24572 tons (including 6061 tons of prawn) was landed by trawls. The catch rate for the total fish and the prawns showed an increase over that of previous year.

There was a marked increase in the relative abundance of demersal resources off Waltair during the current year with an estimated catch of 131 tonnes and catch rate of 112 kg./hr. Highest catch rates of 214 kg/hr in May and 215 kg/hr in February, were obtained by Meena Shodak and Meena Jawahar respectively. Compared with the last year, the catch of the private boats increased by 42%.

Progress of work

During the year analysis of the Catch and effort data of mechanized vessels of the Governmental and Private agencies operating at different centres, including the data of the Indo-Polish Industrial Survey 1977 off Bombay-Sanrashtra coast, was made. In addition, biological studies on the major demersal species were conducted at different centres.

Bombay: The EFP trawler Meena Bharati fished for 5 months, January to March & June to July covering the areas 17-72, 18-72, 19-71, 19-72 & 20-70. Area 17-72 gave the better catch and catch rate figures than other areas (25260 Kgs @ 321.78 Kg/hr). The dominant part of the catch was of cat fish (207.45 Kg/hr). The square 17-72/2B gave the highest rate of 535.2 Kg/hr. In other areas the catch rate varied 115.7 to 162.8 kg/hr and squares 18-72/1B, 5c; 19-71/3C, 5A; 19-72/5B 20-70/1F gave relatively high catch rates of 254.5, 223.42, 360.0, 203.0, 220.5 and 307.13 kg/h respectively.

Analysis of Meena Sangrahak data for January-November in areas 17-72, 18-72, 19-71 & 19-72 showed that the square 18-72/5D gave the highest catch (4947 Kg) while the highest catch rate (208 Kg/h) was given by 17-72/6D. Squares 17-72/6F, 18-72/6E,2F and 19-72/1D recorded nil catches. Apart from miscellaneous group which accounted for 39%, elasmobranchs constituted 24%, dhoma 16% and cat fish 14%. The absence of Dera and the relatively poor catch of eel and koth are note-worthy.

Meena Prapi fished in Bombay waters only during the I quarter (as it shifted operations to veraval later) trawling in areas 17-72 & 18-72 and catching 39, 844 kgs @ 171.38 kg/h. Cat fishes (50%)were dominant.

The Indo-Polish Industrial Fishery Survey was concluded during the year in the Bombay-Saurastra waters. There were six cruises 3 using bottom trawl and 3 midwater & Pelagic trawls. Analysis of results of cruises I to IV covering depth zones of 31-50m, 51-70 & 71-200m showed:

Gear		Depth Z I	Zone II	Zone III
		C C/E	C C/E	C C/E
I	Cr.Bottom T	20817/202.4	8065/150.17	2349/73.98
	Pelagic T	6794/262.93	8162/532.4	2199/95.61
II	Cr.Pelagic T	89579/489.5	102478/1479.8	42725/1206.58
III	Cr.Bottom T	2433/113.16	12758/305.58	5083/287.66
	Pelagic T	84931/627.58	1297/127.53	182.21.85
IV	Cr.Pelagic T	20583/142.71	259/5.66	1033/24.57

In addition to the catch analysis biological observations were made on the following species: Tachysurus maculatus, Nemipterus japonicus Pampus argentius, Cybium guttatus.

Cochin: Analysis of the data from the trawling operations of vessels of the IFP & EFP was carried out during the year. While the medium boats trawled in the close shore waters, the larger IFP vessels - Klaus Sunnana, Velameen, Tuna and Samudradevi fished in the deeper areas. The medium boats trawled only during the I quarter of the year. The EFP vessel Meena Utpadak fished off Cochin in shallower regions though occasionally in deeper waters (250m). In the last quarter Meena Sachatak also took part in the trawling operations. The details of catch, effort etc., are given below:

IFP Vessels

Med. Boats		Larger vessels			Trawling deep water		
C	C/E	E	C	C/E	E	C	C/E
I Qr. 28.17/592/21.02		650.99/97771/150.19			116.65/13550/116.16		
II Qr.	Nil	718.82/160133/222.77				Nil	
III Qr.	Nil	727.81/102046/140.21				Nil	
IV Qr.	Nil	753.15/87674/116.41				Nil	

Area covered: 7-77, 8-77, 8-76, 8-75, 9-76, 10-75 & 10-76.

EFP Vessels

	Shallow Region			Deeper region		
	E	C	C/E	E	C	C/E
I Qr.	84.82/13527/159.29				Nil	
II Qr.	136.53/36134/264.66				Nil	
III Qr.	6.0 / 477/ 79.5			29.0/5385/185.69		
IV Qr.	213.25/31450/147.48				Nil	

Area covered: 9-75, 9-76, 10-75 & 10-76.

Tuticorin: Three EFP vessels Meena Niryantak, Meena Niryantak, Meena Saudagar and M.F.V. Jheerga trawled in areas 8-77, 8-78, 9-78 landing 219.8 tonnes in 2278 hours at 96.5 kg/hr. Both 24 and 20 M trawls were used. The highest catch was from 8-78/4B and the catch rate from 8-77/1F (222.6 kg/hr). Perches and rays were the dominant part. Prawns and Lobsters were never caught.

	24m Trawl Net			20m Trawl Net		
	E	C	C/E	E	C	C/E
Meena Niryantak	1617.67/63450/102.7			145.75/12646/86.6		
Meena Saudagar	648.42/66754/103			223.08/13242/59.4		
M.F.V.Jheerga	271.33/29185/107.7			372 /34566/92.9		
Total	1537.42/159389/103.67			740.83/60454/81.6		

Madras: Of the two EFP vessels that fished off Madras Meena Sitara fished for 11 months and Meenagaveshak for 10 months. Together they caught 104,620 kgs in 558 hrs at a rate of 121.84 kg/hr. The areas fished were 10-79, 11-79, 12-80, 13-80 & 14-80. Though the catch and effort were slightly lower this year than in the previous year the rate has shown an increase. The highest catch rate of 421.2 kg/hr was caught from 14-80/3B in July and the poorest (1.33 kg/hr) from 13-80/4B in May. Silver bellies and rays constituted the major part of the catch.

Kakinada: An estimated 24572 tonnes of catch (including 6061 tonnes of prawns) were landed by trawlers fishing off Kakinada. There was during the year a significant increase in effort, total catch as well as prawn catch. The total catch rate and the prawn rate showed increase over that of the previous year. The rate for all fish was 46.6 kg/hr and for prawns 10.2 kg/h in 1976 and in 1977 they were 53.5 and 13.2 kg/hr. The details of catch and effort are.

	Pablo			Pomfrets & Royas			Sorrahs		
	E	C	C/E	E	C	C/E	E	C	C/E
I	Qr.	16068	842083/52.41	139767	7318750	52.36	19254	1759634	91.39
II	Qr.	16992	781614/46.0	92106	5537692	60.12	20672	1516234	76.25
III	Qr.	11640	493152/42.37	58828	2625037	44.62	12792	622496	48.66
IV	Qr.	9612	273748/28.48	64214	2395173	37.3	12752	406328	31.86

Waltair: The two EFP trawlers fished, Meena Shodak and Meena Jawahar, off Vishakapatnam in areas 16-81, 16-82, 17-83 and 18-84 catching 131221 kgs in 1177 hrs at a rate of 111.5 kg/hr. The corresponding catch and rate for 1976 being 120017 kg and 72.7 kg/h, this reveals an improvement in the relative abundance of demersal resources during current year which was partly due to increased catches of Meena Jawahar (83754 kgs at the rate of 110.9 kg/h as compared to 72273 kg at 81.6 kg/h in the last year) overcoming even a slight decrease in the other vessel's catch. The highest catches were in January (11588kg) the highest catch rate of 214.2 kg/h was revealed in May for M.Shodhak

and corresponding values for M. Jawahar were 18171 kg in February and 215 kg/h also in February. Miscellaneous-small group of fishes contributed to the bulk of the landings (60%) (abundant particularly in January, February and July-August). Cat fishes formed 16%.

	M. Shodhak		M. Jawahar		
	E	C/h	E	C	C/E
I Qr.	125.51/18831/150.04		244.15/44693/183.06		
II Qr.	133.09/17200/120.24		232.4/24198/104.12		
III Qr	150.92/11031/ 73.09		199.32/12152/60.97		
IV Qr.	12.17/405/33.3		79.5/2711/34.1		
	421.69/47467/112.56		755.37/83754/110.88		
	1177.06	/ 131221	/11.48		

Private Boats of the 3 categories Pablos, Royyas and Sorrahs together landed an estimated 2219 tonnes during the year of which 61% was by Royyahs, 32% by Sorrahs and the rest by Pablos. Compared with the last year the catch of the private vessels increased by 42%.

	Royya			Sorrah			Pablo		
	E	C	C/h	E	C	C/E	E	C	C/E
I Qr.	16384.58/	173169/	10.57	9285.13/	98890/	10.65	2790.56/	16932/	6.07
II Qr.	18089.46/	521316/	28.82	9208.42/	266447/	28.94	2223.62/	42051/	18.91
III Qr.	17506.71/	227168/	12.98	9033.6/	141217/	15.63	2672.53/	26246/	9.82
IV Qr.	22029.56/	428913/	19.47	8066.01/	206660/	25.62	3542.41/	70073/	19.78
Total	74010.31/	135066/	18.25	35593.16/	713214/	20.04	11229.12/	155302/	12.83

Total: 120832.59/ 2219082 /18.36

Port Blair: Owing to delays in the receipt of data from outside organisations the account of the fishing operations off Andamans is incomplete. The completed account would be incorporated as early as received.

Work contemplated:

Studies on the evaluation of the demersal resources on the above lines will be contibued at the selected Centres. The analysis and the evaluation of the data of the remaining cruises (Vth and VI) of the Indo-Polish Industrial fishery survey will also be undertaken.

Studies on the resources of flat fishes and Pomfrets (FB/DR/1.5)

G. Seshappa, J.P. Karbhari, G. Nandakumar.

Salient findings

The production of Malabar sole (Cynoglossus macrostomus) at Calicut during 1977 amounted to 274 tonnes which is about 28% less than the average catch for the past eight years. The bulk of the landings of this species were obtained by mechanised trawl boats. Maximum landings were obtained in December. The fishery was supported by the size group 60-140 mm. About 86 tonnes of the species have also landed at Puthiyappa, Recruitment of young ones was observed in May.

The fishery for C. macrolepidotus at Mandapam was more productive in 1977 with an estimated catch of 24 tonnes from Palk Bay yielding a catch rate of 1.4 kgs. Maximum catch was obtained in January. The modal size was 150-340 mm. The species appears to breed during the late winter and early summer months.

The pomfret fishery at Veraval during the year was not so good as the previous year with an estimated catch of 1282 and 1887 tonnes respectively. The fishery was supported by fish of 20-35 cm. Gillnets and trawl nets were the main gear employed in the fishery.

Work done

Flat fishes

The estimated total landings of Malabar sole at Calicut during 1977 amounted to 274 tonnes as against 485 tonnes in 1976. This year's production was about 28% below the average production for the past eight years. The main landings were obtained by the mechanised trawling Units, with/gate of 24.8 Kgs. The landings /catch

by these units were best in December, the next best being in February. The trawl fishery at Puthiyappa has yielded a total catch and catch rate of 77 tonnes and 14.2 Kg. respectively. About 4.4 tonnes were also landed by 'Pollenkolli' Units. Fairly good quantities of C.dubius were landed at Puthiappa. The size varied from 4 -17 cm. The smallest size (40-49 mm) was recorded in May. The modal groups ranged mainly between 6.5 and 10.5 cm. during pre-monsoon period and between 12.5 and 14.5 during September - December period.

A total of 24 tonnes of large scaled tongue sole (C. macrolepidotus) was landed at Mandapam, from Palk Bay, by mechanized Units, with a CPUE of 1.4 Kgs. Both catch and the catch rate was better during the current year as compared to preceeding year. Highest catch (5.2 tonnes) and catch rate (3.5 kg.) were recorded during January.

The size range during the year was 141 - 450 mm for females and 141 - 390 mm for males. The smallest modal size (151-160 mm) for both the sexes was noticed in April. Fishes in advanced stage of maturity were noticed in March. The spent females formed 40% in March, 27% in April, 8% in May and 17% in June.

C.bilineatus was also recorded in stray numbers having a size range of 155 - 360 mm.

Promfret

The pomfret (Pampus argenteus) fishery at Veraval during the year was not so good with an estimated landings of 1282 tonnes as against 1888 tonnes obtained in 1976. Gill nets and trawls were the main gear employed in the fishery. The size varied from 200 mm to 354 mm, with the highest average length (296 mm) in November and lowest (261 mm) in May. Females out numbered males in the catches and fishes with mature ovaries were more in numbers than those with immature ovaries.

Work contemplated

Work on the commercially important flat fishes and Pomfrets at the selected centres will be continued to monitor the fishery and biological characteristics.

Studies on the commercially important elasmobranch resources (FB/OF/1)

M.D.K.Kuthalingam, R.Soundararajan, M.E.Rajapandian, P. Devadoss, S.G. Vincent.

Salient findings

In general there was slight decline in the fishery for sharks and rays during the current year at all the observation centres. Sharks and rays constituted the predominant group in the landings. Highest catch of elasmobranches was obtained at Sakthikulangara (Neendakara) than at other centres, forming 47% of the total Marine fish landings. Drift nets contributed to the bulk of the catches at all the observation centres. Analysis of the gut contents of Sphyrna lewini revealed that it feeds mainly on cephalopods and mackerel. While Amphotistius Kuhlii mainly feeds on polychaets and small crabs, A.imbricatus feeds on small Prawns, fishes and squids. Embryonic studies at Calicut indicated that Scoliodon laticaudus, Himantura macloti and S. lewini can produce 10-16, 2 and 20 embryos and during the period July-November, September and September-October respectively.

Progress of work

Studies on the fishery and biology of the commercially important elasmobranchs were continued at the Calicut, Neendakara, Vizhinjam, Tuticorin and Mandapam centres.

The estimated catch of sharks, rays and skates was 107 tonnes forming 3.9% of the total fish catch at Vizhinjam. The component of sharks was 83 tonnes represented by Carcharhinus Sp. Loxodon macrorhinus and Scoliodon laticaudus; that of rays was 17 tonnes the bulk of which was contributed by Himantura bleekeri. Skates with 6.7 tonnes were represented mainly by Rhynchobatus diiddensis. Drift nets contributed to 89% of sharks, 83% of rays and 80% of the skates landings.

The elasmobranch fishery at Neendakara produced an estimated catch of 3716 tonnes forming 47% of the marine fish landings, Drift nets contributed to the bulk of the catch.

Of the total catch; sharks contributed 1213 tonnes, rays 2292 tonnes and skates 211 tonnes. Sphyrna lewini among the sharks; Amphotistius imbricatus, Rhinoptera javanica, Gymnura Sp. , Himantura bleekeri and H.Uarnak among rays and Rhynchobatus djiddensis among the skates were the dominant species.

S.lewini contributed to 48% of the shark landings. Fish of sizes 41-70 cm formed the bulk of the catches during the first quarter. The size in the annual fishery ranged from 41 to 240 cm. Females dominated the catch. Analysis of stomach contents showed that the species feeds mainly on cephalopods and mackerel.

A total of 185 tonnes of rays were estimated to have landed at Mandapam by Trawlers. The maximum catch was recorded in the first quarter and the minimum during the third quarter of the year. At Pamban a total of 63 tonnes of sharks were caught by sail boats using drift nets from Gulf of Mannar. Predominant species were Amphotistius kuhlii and A. imbricatus which had a size range of 115-335 mm and 115-225 mm respectively in the fishery. While the later feeds on small Prawns, fishes, Squilla and squids; the later was found to feed on Polychaets and small crabs.

A total of 224 tonnes of sharks were landed from Tuticorin area, while skates and rays were landed from Alanthalai, Manapad, Vaipar, Tuticorin and Punnakayal fishing Centres. Drift nets were the main gear employed through out the year at all centres. The dominant species of sharks landed were Carcharius limbatus and Loxodon macrorhinus. They ranged in size from 77 to 120 cm. Detailed biological studies on the later species are in progress. Among the females examined 68% were pregnant. The size of the embryos measured from 78 - 450 mm in length.

The fishery for sharks and rays at Vellayil (Calicut) produced an estimated 108 tonnes during July-December period. They were caught mainly by drift nets and Hooks and lines. Work on the biology of Scolidon laticaudus, H. macloti and Rhinoptera javanica is in progress. The number of embryos in the case of S. laticaudus varied from 10 to 16 Almost in all cases both the

uterii are functional. It is observed that while H. macloti produces 2 embryos; S. lewini produces 20 embryos. Based on the embryos collected it is indicated that the above three species liberate the young ones during July - November, September and September - October periods respectively.

Work contemplated

Work on the above lines will be continued on all commercially important species at the selected centres. It is also proposed to initiate biological studies on Rhynchobatus diiddensis at Vizhinjam.

Culture of Marine Fishes (FB/CUL/1.1)

T. Tholasilingam, G. Venkataraman, P. Bensam, V. Ramamohana Rao, T. Appa Rao, S. Rueben, M.H. Dhulked, R. Marichamy, K.M.S. Ameer Hamsa, P. Nammalwar.

Salient findings

The milkfish, Chanos chanos, was found to grow rapidly and to reach a marketable size within 4½ to 5 months. Preliminary experiments on induced breeding of the sand whiting, Sillago sihama, by injecting pituitory harmones indicated rapid maturation of the ovary.

Work done

Experiements on the culture of marine fishes were carried out mainly from the Research Centres at Mangalore, Tuticorin, Waltair and from the Regional Centre, Mandapam Camp.

Field experiments on the culture of Sillago sihama were carried out in the fish farm at Mulky and Coonadapur (South Kanara District). At the Mulky farm (0.2 ha area), 1800 fingerlings (5-7 cm) of the species, collected from the Coondapur estuary and transported over a distance of 60 km to the farm site, were stocked by the end of January. Harvesting of the stocked Sillago was conducted after four months, in May. Although

the production rate was low, some of the fishes had shown good rate of growth as indicated by the size and weight which varied from 70 to 229 mm and 3.5 to 99 gm respectively. A second experiment was conducted in the same field from June to the middle of September with the milkfish, Chanos chanos. 500 fingerlings (50-60 mm) collected from Coondapur were stocked in the field. When they were harvested after 4 months, they attained a size, ranging from 244 to 262 mm and weight varying from 100 to 120 gm.

In the farm at Coondapur (0.17 ha), experiment on the culture of Sillago was started in December 1977 with the stocking of 1175 fingerlings.

Attempts were made for induced breeding of S.sihama by injecting pituitory extracts of the fresh water/marine catfish. Although Sillago responded to the harmonic injection, on two occasions, they failed to liberate viable eggs.

At Narakkal, Chanos fingerlings (45 mm) collected from the fish seed ground at Vypeen Island, were stocked along with prawns in 0.1 ha pond. The culture operation was carried out without providing any supplementary feed, but they were found to feed actively on the blue given alga , Anabaena sp. growing in the pond. At the end of 4½ months of culturing in the pond, the fish attained a marketable size of 450 mm with an average weight of 420 gm. The percentage of survival was 70. Culture of this fish for larger duration of over five months, indicated that the growth rate leveled off after 6 months.

Polyculture experiments with P.indicus, Chanos chanos and Mugil macrolepes were conducted at Tuticorin for a period of 8½ months in a fish farm of 0.28 h.area. The stocking was done at a rate of 3:1:1 in respect of P.indicus, milkfish and the mullet. The result of the experiments was although poor in terms of yield due to the presence of several predating animals, the growth rate of the prawn and the fish cultured were found to be satisfactory.

At Mandapam, fishes such as mullet and milkfish, and the prawns like Penaeus sp. and Metapenaeus sp. were cultured in pens. Two pens measuring 9m x 9m and 18m x 9m and enclosing an area of 81 and 162 sq.m respectively were fabricated with bamboo screens and erected in the inshore water in the Gulf of Mannar. A special barricade with Cassurina poles and stones was provided, on the seaward side in order to arrest the direct wave action on the pens. 3288 fingerlings of Mugil, 77 Chanos and 690 prawns were stocked in one of the pens in March 1977. In the other pen, 1227 Mugil, 190 Chanos and 1845 prawns were stocked during September - December. The stocked fishes and prawns were fed with the measured quantities of minced fish meat and oil cake. In June and July, heavy mortality of the fishes and Prawns occured due to the blooming of Trichodesmium thiebauti. Those survived showed a growth increment of 18.3 mm, 50 mm, and 30 mm respectively for mullet, milkfish and prawns during a period of six months.

Besides the above experiments, 90 eggs of the turtle, Olive Rideye (Lepidochelys olivacea) collected from the natural nesting places of Hare Island, were successfully hatched and reared for further culture experiments in pens.

A survey of the Bheemunipatnam backwaters to assess the availability of suitable resources and sites for coastal aquaculture was undertaken. During January - February and July - September zooplankton dominated in the backwaters. Phytoplankton was seen to be abundant from March to June. The pH value of the backwaters was found to be more or less constant at 8.0 in most of the months. The dissolved oxygen of the backwaters was low in February. In other months, it varied from 3.34 to 6.67 ml/l. The salinity was relatively high (30.95 - 32.81%) during June - July. In August low value was recorded and thereafter it gradually increased to reach 26.4% in September. The commercial fish and prawn fauna of the backwaters included mullets (Liza macrolepis, Valamugil sp,

M. cephalus), Gerres sp. Therapon jarbua, Ambassis sp. Chanos chanos, P. indicus, M. dobsoni and M. monoceros. Of these, mullets and prawns were dominant in the catches. Chanos chanos was encountered rarely.

Work contemplated

It is proposed to take up intensified research on the induced breeding of the milkfish (Chanos chanos), Sand whiting (Sillago sihama) and mullets. Polyculture of compatible marine fishes and prawns will be undertaken to demonstrate the feasibility of utilization of the entire ecosystem for obtaining increased production.

Culture of eels (FB/CUL/1,2)

K. Dorairaj, R. Soundararajan.

Salient findings

Fish Seed surveys of Rameswaram Island, Pamban and Mandapam areas /were conducted/ for locating elver concentration centres for commercial exploitation. The survey has indicated that a good collection of elvers can be made especially during rainy season for commercial purposes.

About 20,000 elvers are being reared in the eel culture laboratory. These are sorted out into glass eels and the small elvers and were initially fed with minced earthworm, clam meat and trash fish for about a month. The overall increase of average weights in glass eels during six months period ranged between 0.45g to 0.85g which works out to four to six times of the initial body weight. With regard to small elvers six months average increase in weight ranged from 1.0g to 1.8g which works out to about three times of the initial average body weight.

Work contemplated

Large scale collection of the elvers from the potential grounds and their culture on commercial scale will be done.

CRUSTACEAN FISHERIES DIVISION

Various aspects of the Crustacean Fisheries of the country during 1977 were studied under seven research projects. Of these, four projects were related to capture fisheries and the rest dealt with the culture aspects. Three projects, namely, "Status on prawn fishery", "Development of artificial feed" and "Studies on the salinity tolerance of penaeid prawns" were completed.

The highlights of the research works carried out in the division during 1977, were, (1) the estimated prawn landings of the country during the year were less by 53,000 tonnes over that of the last year. However, the biological characteristics of the prawns supporting the fishery at various regions did not show any significant variations except at Kakinada where the non-penaeid prawns dominated the prawn landings, relegating the penaeid prawn fishery to a secondary status; (2) the lobster fishery on the north-west coast of India continued to be better than that of the south-west coast, which till recently contributed to the bulk of the lobster landings; (3) the green tiger prawn, Penaeus semisulcatus, was successfully spawned and its larvae reared up to the postlarval stage under laboratory conditions for the first time; (4) a simple technique for combined culture of phytoplankton and early penaeid larvae in plastic pools was developed; (5) under intensive culture it was established that the prawns such as, P.indicus, P.monodon, and Metapenaeus dobsoni reach marketable size in 3-4 months; and (6) P.monodon could be advantageously cultured in the salt pan reservoirs along with the manufacture of salt.

Assessment of Prawn Resources (CF/RE/1.1)

S.Ramamurthy, M.S.Muthu, M.M.Kunju, M.M.Thomas, N.S.Kurup, N.N.Pillai, C.Suseelan, M.Kathirvel, K.V.George, K.N.R.Kartha, K.N.Gopalakrishnan, J.P.Karbhari, S.Shanmugam, G.Nandakumar, G.Sudhakara Rao, T.Balachandran, K.Koumudi Menon, M.Aravindakshan, K.K.Sukumaran, P.A.Thomas, K.Y.Telang, K.Devarajan, P.E.Samson Manikkam, K.N.Rajan and others.

Salient findings

Since the peak landings of 1975, the marine prawn catch of the country was showing a declining trend, the decrease being to the tune of 12.3% from 1975 to 1976, 30.7% from 1976 to 1977 and 36.4% from 1975 to 1977. While no appreciable variations in the overall distribution pattern of the species, the size and seasonal abundance were observed, this year's fishery showed two noteworthy features, namely, (1) the percentage contribution of P.stylifera in the fishery of the south-west coast increased significantly and (2) the species composition of the prawn fishery at Kakinada indicated higher percentage of small sized non-penaeid prawns in contrast to the dominance of penaeid prawns in the earlier years. The reduction in mesh size of the trawl nets operated in this region was found to be one of the important contributory reasons for the changing pattern of the species composition of the area.

Work done

The marine prawn fisheries of India declined during this year, the estimated catch being 1.40 lakh tonnes* as compared to 1.93 lakh tonnes during 1976. Penaeids accounted for 61.1%. Statewise landings are given in Table-6. A heavy decline in the catch was noticed in Andhra Pradesh, Maharashtra and Gujarat except in the case of non-penaeids in Andhra Pradesh.

The details of the prawn fishery at the various centres of observation are given in Table-7. The catch per hour of trawling on the west coast varied from 6.2 kg at Mangalore to 19.0 kg at Cochin,

* Provisional

whereas on the east coast, it varied from 1.0 kg at Waltair to 15.5 kg at Kakinada. The catch showed an improvement at Goa, Calicut and Cochin. The last centre witnessed a two-fold increase which was chiefly due to the heavy landings of Parapenaeopsis stylifera. Though there has been an overall decline in the catch of prawns at Mangalore, the fishery for Metapenaeus monoceros improved further during this year. On the east coast, the prawn catch registered a decline at all the centres except at Kakinada. A reduction in the cod-end mesh of the trawl net from 25 to 10 mm was noticed at this centre during the latter half of the year. The prawn fishery witnessed a double-fold increase mainly due to small sized nonpenaeids which formed 54.7% of the landings.

At Bombay, M.affinis was the dominant species as in the earlier years. At other centres on the west coast, P.stylifera was the chief constituent. On the east coast, Penaeus semisulcatus formed the mainstay of the fishery at Mandapam. At Madras and Kakinada, M.dobsoni was the principal species, whereas at Waltair, it was M.monoceros.

Indigenous gears landed considerable quantities of prawns at Bombay, Calicut and Puri, though the catch was poor compared to 1976. P.stylifera closely followed by Acetes indicus predominated at Bombay while P.indicus and P.merguiensis were important at Puri.

The catch of juvenile penaeids in the backwaters/estuaries varied only marginally as compared to 1976. M.monoceros was predominant at Goa and Kakinada. At other centres on the west coast, the chief species was M.dobsoni; at Puri, it was P.indicus.

Better recruitment of postlarval stages and juveniles, particularly of M.dobsoni in the estuary at Calicut, was reflected in the improved landings of this species in the marine environment of that region during the current year. In the Cochin backwaters, though the

recruitment of postlarvae of M.dobsoni was poor, try net collections indicated better representation of the juvenile population during the first three quarters. The marine fishery at this centre turned out to be good principally because of P.stylifera. The fishery for M.dobsoni in the coming quarter (January - March 1978), is likely to continue on a low level as indicated by poor representation of juvenile population during October-December 1977.

Biological details

P.indicus: This was the chief species in the inshore catches at Puri. The fishery suffered considerable decline during this year on the southwest coast. The mean length for males and females in the exploited population at Mangalore and Calicut, showed reduction as compared to that of the previous year. The peak breeding season was during October-December at Puri and from January to March at Calicut. Juveniles (63-113 mm) of the species formed a sizable fishery in the backwaters/estuaries at Puri during May-July, at Kakinada during June-August, at Cochin during February-April, and at Calicut during May-June.

P.merguiensis: Formed one of the important constituents in the inshore catches by the indigenous gear at Puri in November. Mature/spent females were noticed in more numbers during October-December. Sizable quantities were also landed by the mechanised fishing vessels at Goa during January-May and at Kakinada, during February-May.

P.semisulcatus: About 98% of the prawn landings by the mechanised fishing vessels at Mandapam was constituted by this species. The mean length was estimated to be 112.4 and 130.9 mm for males and females respectively. Mature/spent females were common during February-March and September.

P.monodon: Appreciable quantities of this species were landed by the trawlers at Kakinada during January-April and at Waltair during January-March and August-September. Young prawns (128-143 mm) were encountered more frequently during April-August in the Chilka lake and during January-February, July-August and October in the

estuaries at Kakinada. The size of juveniles at the latter centre ranged from 53 mm to 133 mm.

M.dobsoni: A marked decline in the landings at Cochin and Mangalore was witnessed. At Calicut, the fishery improved three-fold. At Kakinada, it was the chief penaeid species. The mean length of the population, during the current year, increased at Calicut, whereas at Mangalore it decreased as given below.

	Male (mm)		Female	
	1977	1976	1977	1976
Calicut	77.4	68.5	92.4	80.8
Mangalore	71.9	79.2	82.6	92.2

M.affinis: This was commercially important at Sassoon Dock(Bombay). The fishery suffered a decline at Goa, Mangalore and Cochin, and was actually absent at Calicut. Percentage of mature females was high in January at Goa, and during the latter half of the year at Puri.

M.monoceros: This species ranked second in the penaeid prawn landings at Mangalore and Kakinada. The mean length of the species at Mangalore was 113.9 mm for males and 131.6 mm for females. Small sized prawns (68-78 mm) constituted the mainstay of the fishery at Kakinada during April-October. Recruitment of juvenile prawns into the fishery at Mangalore was observed during February-March.

P.stylifera: This was the principal species exploited on the west coast, between Veraval and Cochin during the year. At Cochin, the landings were heavy; on the east coast, it was caught in fair quantities at Kakinada in April. The mean length of both the sexes in the population exploited at Calicut and Mangalore showed a decreasing trend.

	Male (mm)		Female	
	1977	1976	1977	1976
Calicut	80.1	80.7	85.0	86.1
Mangalore	77.8	82.2	89.2	91.8

Ripe females were more during January-April and November-December. Recruitment of small sized prawn took place during April-May and November-December. The total instantaneous mortality for females was estimated to be 7.8 at Mangalore.

Work contemplated

For more effective monitoring of the exploited prawn resources of the country, it is proposed to modify this project into 3 components to deal separately with pe-naeid prawn resources, non-penaeid prawn resources and prawn resources in the nursery grounds, and to intensify the research activities.

Assessment of lobster and crab resources (CF/RE/1.3)

M.S.Muthu, P.V.Kagwade, J.P.Karbhari, W.Venugopalan, M.Kathirvel, S.Shanmugam, K.M.S.Ameer Hamsa.

Salient findings

The northwest coast (Saurashtra and Bombay) continued to be the major lobster producing region in the country. The lobster fishery of the southwest and southeast coasts(except at Mandapam area) failed to a great extent during the year. While this failure might be due to the natural fluctuations in the resources, the biological characteristics of the exploited population did not show any significant variations from those of the previous years. Panulirus polyphagus was the dominant species supporting the fishery on the northwest coast and P.homarus on the southwest and southeast coasts.

TABLE - 6

Statewise landings of Prawns (in tonnes) (figures for 1977 only provisional)

State	Penaeid		Non Penaeid	
	1977	1976	1977	1976
West Bengal	454	2,139	218	1,708
Orissa	788	688	13	100
Andhra Pradesh	4,942	8,833	6,647	2,275
Tamil Nadu	8,196	10,156	159	194
Pondicherry	103	93	2	-
Kerala	40,149	34,478	174	55
Karnataka	2,539	2,594	-	-
Goa	1,436	4,981	24	-
Maharashtra	20,029	40,772	45,920	63,702
Gujarat	6,850	11,497	1,200	7,778
Andaman	45	39	-	-
Laccadive	-	-	-	-
Total	85,531	1,16,270	54,357	75,812

TABLE - 7

Prawn fishery at different centres

	Veraval	Bombay	Goa	Mangalore	Calicut	Cochin
OFFSHORE						
Catch in tonnes	1396.7	2573.0	257.7	1283.4	392.1	5336.4
Effort hrs.	-	-	34075	208350	61386	280801
Cpue in kg.	-	-	7.6	6.2	6.4	19.0
Important species *	-	b,i,c	i,a,b	i,c,a	i,a,c	i,a,c
Productive months **	10,11	-	11,12	12,2,3	12,3	8,9
INSHORE						
Catch in tonnes	-	1174.4 (S.Dock)	-	14.5	55.1	4.3
Cpue in kg.	-	57.6 (Boat day)	-	36.3 (castnet)	34.8 (Boat day)	-
Important species *	-	i,k,b,l,j	-	a,e	a	e,a
Productive months **	-	8,9,10	-	8	7	6
ESTUARINE						
Catch in tonnes	-	-	1.9	-	73.2	1426.9
Cpue in kg.	-	-	-	0.05	13.3 (Stake net)	-
Important Species	-	-	c,a	a,e	a,c,e	a,c,e
Productive months **	-	-	8,7	12,2	1,6,10	2,3,4

Contd....

Table 7 contd..

	Tuticorin@	Mandapam	Madras	Kakinada+	Waltair	Puri
OFFSHORE						
Catch in tonnes	264.4	197.7	412.8	5278.0	117.2	-
Effort hrs	2,22786	15941 (Boat days)	1220.5	340817	112532	-
Cpue in kg.	1.2	12.4	3.4	15.5	1.0	-
Important species *	c,h,g,b	h	a,e,c	k,l,a	c,g,e	-
Productive months **	4,6,7,8	10,11,12	1,12,3	6,7,2	8,10,11	-
INSHORE						
Catch in tonnes	12.1	-	-	-	-	110.5
Cpue in kg.	4.0	-	-	-	-	0.2/hr (gill Net)
Important species *	c	-	-	-	-	e,f,b
Productive months **	8,9	-	-	-	-	10,11,12
ESTUARINE						
Catch in tonnes	-	-	-	235.7	-	10.8
Cpue in kg.	-	-	-	7.2 (Drag Net) (Stake net)	-	0.5/hr (drag net)
Important Species *	-	-	-	c,d,e	-	e,g
Productive months **	-	-	-	1,8,10	-	5.7

* a = M.dobsoni; b = M.affinis; c = M.monoceros; d = M.brevicornis; e = P.indicus; f = P.merguiensis; g = P.monodon; h = P.semisulcatus; i = P.stylifera; j = P.sculptilis; k = A.indicus; l = P.tenuipes

** according to Calendar months

@ Jan - Nov. + Jan-Oct

The crab fishery on the southeast coast was of slightly lesser magnitude during the year as compared to that of the previous year.

Work done

Lobsters

Lobster landings by trawlers at Sassoon Docks and Kasara Bundar were 146.7 tonnes during the year as against 117.3 tonnes last year. The fishery was good during January-April and November-December, with peak landings in December. Panulirus polyphagus was the dominant species. P.homarus and Thenus orientalis also occurred in small quantities in the catch.

P.polyphagus ranged in total length from 88 mm to 362 mm, but the majority were measuring between 150 mm and 300 mm. Recruitment of juveniles less than 130 mm during November-January was very poor during the year as compared to that of the last year. At Kasara Bunder, 47.5 to 50.5% of females were berried during January-February and October. The sex ratio was equal.

The bottom-set gill nets operated for lobsters at Thikkodi landed 1.5 tonnes of lobsters during the year as against 1.9 tonnes last year. The average catch per unit of effort was 1.14 kg. Fishing for lobsters were suspended during the monsoon months (June-September) and was affected by the cyclonic conditions in November. The highest catch was recorded in December. P.homarus formed 89% of the catch, while P.polyphagus contributed to the rest. Compared to the last year, there was a reduction in the abundance of P.polyphagus.

The size range of P.homarus was from 126 mm to 265 mm; the majority of specimens measuring between 186 mm and 195 mm. In December, smaller specimens were observed. Females dominated in the catch except in December. 47 to 70 per cent of females were found to be in berried condition during the first quarter.

P.polyphagus ranged in size from 161 mm to 255 mm. Females dominated the catches through out the period except in January.

The lobster fishery of Kanyakumari District showed a marked decline as compared to that of the last year. Only 28.5 tonnes were landed as against 59.7 tonnes last year. The fishing season was from November to April, with peak landings in November-December. P.homarus (93%) and P.ornatus (7%) constituted the catch. The size range of P.homarus was from 81 to 263 mm. In males, the modal length shifted from 131-135 mm in January to 156-160 mm in March. Recruitment of smaller specimens measuring 111-115 mm was observed in December. In females, the modal length shifted from 131-135 mm in January to 151-155 mm in March. Among males, 95% were one year old, whereas in females 59% belonged to 0-year class and 37% to one-year class.

Larger fishing vessels of the Integrated Fisheries Project, Cochin, landed 12.38 tonnes of the deep-sea lobster Puerulus sewelli during January-March, the catch rate being 95.5 kg/hour.

At Kayalpatnam (Tuticorin) 3.8 tonnes of lobsters were landed by bottom-set gill nets during August-December. The catch rate was 4.64 kg/unit. P.homarus formed 64.9% of the catch. The size ranged from 135 to 232 mm in males, and from 168 to 244 mm in females. The modal size of males and females were 183 mm and 188 mm respectively. 50% of females were in berried condition. The sex ratio was in favour of the females.

There was an improvement in the lobster fishery at Mandapam Camp during the year. The gill nets landed 15.9 tonnes during the year, as against 8.9 tonnes last year. But the mechanised fishing vessels landed only 1.1 tonnes of Thenus orientalis during the year as against 5.4 tonnes last year. The gill-net season was good during the year. P.ornatus, P.homarus, P.versicolor and P.longipes longipes were represented in the catches, P.ornatus being the dominant species.

Crabs

At Mandapam Camp, the gill nets landed 90.6 tonnes of crabs (Portunus pelagicus) during the year as against 67.7 tonnes last year while the mechanised fishing vessels landed only 47.9 tonnes as against 86.6 tonnes in the last year. The modal size of P.pelagicus in gill net catches was 135-139 mm and 140-144 mm for females and males respectively. In the trawl nets the modal size for females was at 145-149 mm and for males at 150-154 mm. Berried females were abundant during January-April.

Prawn Fishery Atlas (CF/RE/1.4)

E.G.Silas, M.S.Prabhu, S.K.Dharmaraja, K.Rengarajan, I.David Raj and others.

Work done

Maps and charts depicting the prawn resources and their fishery were drawn and supplemented to the model copy prepared earlier.

Work contemplated

Additional drawings and a draft final copy will be prepared.

Status Report on Prawn Fishery(CF/RE/1.5)(Final Report)

M.S.Muthu, C.Suseelan, M.Kathirvel.

Salient findings

The marine prawn fishery of India for the period 1965 to 1975 was reviewed. The total marine prawn production of the country showed a steady increase from 75,500 tonnes in 1965 to 2,20,751 tonnes in 1975, registering about three-fold increase during the 11 year period. The production figure touched a level of over one lakh tonnes in 1968 and two lakh tonnes after five years.

The significant increase of prawn catches from 1973 was mainly due to increased fishing effort which was estimated above 230,000 thousand man-hours from that year onwards.

The average annual marine prawn production was of the order of 1,36,242 tonnes, forming 13% of the total marine fish production of the country. About 87% of the prawn catches was landed in the west coast. In terms of average annual catch, the state of Maharashtra ranked first, followed by Kerala, Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat and West Bengal and Orissa. However, the prawn catch of Maharashtra was chiefly composed of non-penaeid prawns. The highest catch of penaeid prawns was obtained from Kerala. In recent years, there has been significant increase in the penaeid prawn landings in all the east coast stages as well as in Gujarat.

The penaeid prawns which formed 62% of the total prawn landings, occupied the dominant place throughout the period, except in 1971 and 1972, when the fishery showed a downward fluctuation, particularly on the west coast. The species and its percentage composition of the overall penaeid prawn catch were P.stylifera (28.5%), M.dobsoni (28.1%), M.affinis (11.2%), P.indicus (7.9%), Solenocera crassicornis(S.indica) (6.6%),P.merguiensis (3.8%), M.monoceros (2.9%), M.brevicornis(2.4%), P.semisulcatus (2.1%), P.sculptilis(1.3%) and P.monodon(1.0%). P.stylifera was caught mostly from Kerala (66.6%) and Maharashtra (15.6%). The major source of M.dobsoni was Kerala (80.8%) followed by Karnataka (7.6%) and Andhra Pradesh (6.2%). M.affinis was predominantly exploited from Maharashtra (30.0%), Kerala (23.9%) and Gujarat (21.2%). Over 60% of the catch of P.indicus came from the east coast particularly from Tamil Nadu (36.7%) and West Bengal and Orissa (20.7%). In the west coast, Kerala (34.9%) was the best producer of this species. S.crassicornis was caught predominantly from Maharashtra. The resources of P.merguiensis was mostly restricted to the middle and northern sectors of the west and east coasts. The bulk of the catches having been landed from West Bengal and Orissa (68.4%), Karnataka (25.9%) and Goa. The maximum catches of M.monoceros (42.3%), M.brevicornis (60.2%) and P.monodon (70.6%) were recorded from Andhra.

P.hardwicki and P.sculptilis were largely caught from Maharashtra (90-100%), while the bulk of P.semisulcatus catch came from Tamil Nadu.

The catches of non-penaeid prawns were remarkably high in 1971 and 1972, but failed to maintain this trend in the subsequent years. Maharashtra contributed to 93.9% of the total non-penaeid prawn catch of the country followed by Andhra (2.6%), and Gujarat (1.1%). In Maharashtra, the fishery was supported by Acetes indicus (53%), Palaemon tenuipes (39%), Hippolysmata ensirostris (5%) and P.styliferus and others(4%).

The period under review witnessed progressive increase of small mechanised fishing vessels year after year for prawn fishing. In 1965, prawn catches by the mechanised fishing vessels formed only 3% (2308 tonnes) of the total marine prawn landings. But it increased to 10.5% in 1975. The development of mechanised prawn fishery was relatively faster on the east coast, where its contribution increased from less than 1% in 1965 to 8.8% in 1975. The effect of concentration of large number of mechanised fishing vessels and their intensive fishing on the prawn resources in certain centres along the coast was evaluated and discussed.

The period also witnessed the introduction of bottom-set gill nets to catch large sized prawns, particularly on the southwest and east coasts.

An appraisal of the marine prawn fishery revealed that (1) the fishery was contributed by multi species that co-exist in the fishing grounds and (2) the different species although occurred simultaneously in the same fishing ground showed great variation in seasonal and annual abundance. Consequently, wide fluctuations in the yield of prawns were observed in the exploited fishery of all the regions. These features, together with their exploitation in the estuaries and backwaters in the juvenile stage, make the dynamics of the fishery (particularly of penaeid prawns) more complex. However, the biological features such as the capacity to produce large number

of eggs, protracted breeding, fast rate of growth, short life span, and ability to withstand wide changes of the environment help to maintain their population and to the continued success of the prawn fishery.

The review also helped to identify certain gaps in the present knowledge of the prawn resources of the country. These gaps are mainly related to the factors influencing recruitment, growth and survival, their behaviour and migration, the structure, characteristics and nature of the population or the stock. It was also observed that the information on the prawn resources beyond 40-50 m was limited, except for the occurrence of rich concentration of deep-sea prawns at 300-375 m depth zone off the southwest and southeast coasts. While a systematic and planned survey of the prawn resources in the outer half of the continental shelf waters and beyond had become an imperative need for further developments and expansion of the fishery, the effect of fising on different species in different regions required continuous watching and evaluation in order to sustain the coastal prawn fishery.

Work done

Based on the data collected, analysed, and consolidated a draft report was prepared. The project was completed during the year.

Culture of prawns and crabs (CF/CUL/1.1)

P.Vedavyasa Rao, M.S.Muthu, N.N.Pillai, S.Ramamurthi, K.A.Narasimham, V.Sriramachandra Murthi, K.Devarajan, K.Y.Telang, G.Sudhakara Rao, J.Sunny Nayagam, M.Narayanan and Others.

Salient findings

The green tiger prawns, P.semisulcatus was successfully spawned and its eggs reared up to the postlarval stage under laboratory conditions for the first time in the country. Preliminary experiments on induced maturation and breeding of prawnsunder controlled

conditions showed that the ovary of P.indicus on cauterisation of its eye stalks, matured rapidly to ripe condition within 9 days, but the prawn failed to liberate viable eggs under the experimental conditions. A simple technique for combined culture of phytoplankters as well as the penaeid prawn larvae in fertilized sea water in plastic pools was evolved. Field experiments on intensive culture of prawns indicated that P.indicus stocked at a rate of $5/m^2$ registered faster rate of growth than those stocked at a rate of $10/m^2$, $25/m^2$ and $50/m^2$. In the low saline water conditions in the pond, the cultured prawns were formed to be susceptible to a bacterial disease caused by Vibro sp. Experiments conducted on the culture of prawns in different ecological systems revealed that the prawns like P.monodon could be advantageously cultured in the salt pan reservoirs along with the manufacture of salt.

Besides the above, developmental activities such as training of research/developmental personnel in the modern techniques of marine prawn culture, and providing assistance to entrepreneurs and prawn farmers to establish intensive prawn culture enterprises were also undertaken.

Work done

The main emphases of researches carried out on prawn culture during the year were (1) on the perfection of techniques for breeding and rearing of larvae of selected species of prawns to obtain increased survival rate in connection with large scale production of seed, and (2) on intensive culture of prawns under field conditions. The developmental activities taken up under the project related to (1) training of research/developmental/technical/personnel on marine prawn culture, and (2) assisting the entrepreneurs in the establishment of intensive prawn culture.

The research activities on the culture of prawns were mainly carried out at the Prawn Culture Laboratory at Narakkal, in the Field Laboratory at Kovalam and at the Research Centres at Mangalore and Kakinada.

For the first time in the country, the green tiger prawn, Penaeus semisulcatus de Haan, was successfully spawned and the eggs reared upto the postlarval stage under controlled conditions in the Field Laboratory at Kovalam. Viable eggs of P.semisulcatus measured 0.27 to 0.29 mm in diameter. The larval development of the species underwent through 6 naupliar, 3 protozoeal, and 3 mysis stages, with an intermediate stage between the last mysis and the first postlarva. With this species, the commercially important penaeid prawns which were spawned and their eggs reared to the postlarval stages under controlled conditions by the Institute, numbered seven, namely, M.dobsoni, M.affinis, M.monoceros, P.indicus, P.monodon, P.semisulcatus and P.stylifera.

Experiments were performed to induce adult females of P.indicus to attain maturity and breed under controlled conditions. In this connection, electro-cautery of eye stalks was tried. Although unilateral cauterisation found ineffective, expiration of both the eye-stalks led to rapid development of the ovary, and the females became fully ripe within 9 days. However, they failed to spawn. Further experiments on induced maturation and breeding of prawns are progressing.

A series of breeding and rearing experiments were conducted at Narakkal in an endeavour to enhance survival rate of larvae in large scale seed production, and the following system gave better results.

A 1.8 m (6') diameter, plastic pool was set up, with 4 tube lights suspended from a wooden frame. This pool was filled up with 300 litres of filtered sea water, which was fertilised with

nitrate, phosphate, silicate and EDTA. Phytoplankters such as, Chaetoceros sp., Tetraselmis sp., Chlorella sp. and Thallassiosira sp. were introduced into the system. In the meanwhile, the spawners were collected from the sea and were kept individually in 15 litre capacity plastic basins containing filtered sea water. By the time the spawners liberated eggs (which normally occured on the same night of collection of spawners), nauplii hatched out, and metamorphosed into protozoae, phytoplankton culture in the plastic pools also developed into blooms. The protozoae were then counted and introduced into the plastic pools where they grew rapidly feeding on the phytoplankton. For feeding of the late mysis stage larvae with adequate quantities of food, phytoplankton cultured in plastic basins kept in open sunlight was added into the plastic pools. The late larval stages were fed with finely minced squid meat.

The percentage of survival from nauplii to postlarvae of M.dobsoni reared under the above system varied from 0.9 to 26.5 when fed with Tetraselmis sp. and Chlorella sp. and from 45.6 to 54.2 when fed with Thallassiosira sp. and Chaetoceros sp. These experiments also indicated that the latter two phytoplankters are better feeds than the former ones.

Field experiments on intensive culture of prawns were carried out in the brackishwater ponds at Cochin (Narakkaland Kannamaly), Mangalore (Mulky) and in the salt pans at Kakinada. At the Narakkal field, P.indicus (15-20 mm) were stocked at the stocking densities of $5/m^2$, $10/m^2$, $25/m^2$ and $50/m^2$ and their growth was closely followed by monthly sampling. As the pond waters were highly productive, no supplementary food was given during the culture operation. In 110 days after stocking, the prawns stocked at the density rate of $5/m^2$ $10/m^2$, $25/m^2$, and $50/m^2$ attained respectively, a size of 128 mm, 108 mm, 88 mm and 64 mm. The growth was relatively faster during the first 45 days and thereafter it slowed down considerably. The average growth rate of prawns in the pond stocked at a density rate of $5/m^2$

was 1.0 mm per day. If the growth in the first 56 days was taken into account, the growth was much faster, being 1.7 mm per day. During these experiments it was also noticed that low saline conditions affected the prawns and results in large scale mortality due to a bacterial (Vibrio) infection.

To demonstrate the economic feasibility of intensive prawn culture involving culture of selected species such as P.indicus, a perennial farm with a water area of 0.23 hectare at Kannamaly, was selected. The work was initiated in October with eradication of undesirable fauna using Mahuwa oil cake. Two velon screens were fitted to each of the two sluice gates of the farm. The stocking of the farm with P.indicus was undertaken between 15th and 26th November, 1977. A total number of 23000 prawn seed, constituted by 95% P.indicus in the size range of 8-30 mm and 5% of M.dobsoni (8-10mm), were stocked. The seed prawns were mainly obtained from the backwaters in the Vypeen Island. The water conditions as well as the growth of stocked prawns in the pond were regularly followed. The experiment has been progressing.

At Kakinada, the experiments were conducted in a salt pan of 0.2 ha area located at Lakshmipatnam. Juveniles of P.monodon collected from B.V. Palem were transported over a distance of 4 km to the farm site and were stocked at a rate of 30,040/ha in December, 1977. The average size and weight of prawns at the time of stocking were 54.2 mm and 1.04 gm respectively. During the culture operation, the prawns were fed with rice bran at arate of 12-16% of the body weight of the stocked prawns. A total of 1175 kg.of rice bran was given as feed in 155 days. The temperature and salinity of the water during the experimental period varied from 25.5°C to 31.0°C and 21.27‰ to 45,39‰ respectively.

The prawns were harvested after 168 days . An estimated total number of 6192 prawns, weighing 67.3 kg were fished. The survival rate was 79.3 per cent.

Another experiment on polyculture of P.monodon and the milkfish, Chanos chanos, was initiated in June, 1977 in a field of 0.3 ha area. 2197 fry and fingerlings of the milkfish were stocked in the field in June, and after two months, 1628 juveniles of P.monodon (42-106 mm) were introduced. Regular data on the environmental condition of the field as well as growth of the milkfish and the prawns were being maintained.

Culture of Crabs: Experiments on the culture of crabs were mainly carried out at Veppalodai fish farm near Tuticorin. Scylla serrata was the species involved. Young crabs collected from the neighbourhood of the Veppalodai fish farm were kept individually in baskets arranged in a row and suspended from a rope across the field. The size of crabs at the time of stocking ranged from 50 to 80 mm in carapace width. A few larger crabs (100-120 mm) were also stocked.

Based on the observations on 90 crabs, the rate of growth was found to vary from 5 mm to 52 mm per month, 30 percent of the stocked crabs showing a growth rate of 11-15 mm carapace width per month, 27 percent, 5 mm/ month, 32 percent, less than 5mm/months and a few of the crabs 43-52 mm/month. Moulting periodicity was generally noticed between 28-50 days.

Culture of lobsters: Live pueruli and postpueruli of the spiny lobsters, Panulirus homarus, P.ornatus and P.polyphagus were collected from the tiles used for the collection of mussel spats from the inshore watersof Madras and were reared in the 50 litre capacity plastic basins containing filtered sea water. Various types of food such as clam, mussel and trash fish meat and compounded feed composed of fish meal, tapioca powder and rice bran were given to the larvae during the rearing experiments. The growth rate of pueruli of P.homarus in these experiments was found to be 7 mm per month. In a few specimens faster rate of growth than this was also

recorded. In the case of pueruli of P.ornatus, the growth rate registered was 8 mm per month and in that of P.polyphagus, 9 mm per month. Breeding experiment on P.ornatus was conducted in May, 1977, when a berried specimen weighing 1.5 kg produced about 2.5 lakhs of Phyllosoma larvae. The larvae were reared for seven days under laboratory conditions.

Training: To update the knowledge of teachers, research workers, managerial/developmental personnel in the modern technology of prawn culture, a Summer Institute was organised by the Institute during May-June, 1977 on "Breeding and Rearing of Marine Prawns". Sixteen participants from various maritime States, Universities and from the Institute participated in that course. The techniques developed by the Institute on various aspects of prawn culture and cognate fields were effectively transferred to the participants during this training course.

Consultancy: Several privateand public sector entrepreneurs were given advises, suggestion and guidance in marine prawn culture. Several special surveys were also conducted to assist the entrepreneurs in establishing intensive prawn culture of which mention might be made about the survey conducted at the Manjanakad-backwaters and the estuaries and backwaters of Pondicherry and Karikal.

Work contemplated: Directed research will be carried out on (1) problems relating to mass production of prawn seed of selected species; (2) intensive culture of prawns in different ecosystem and (3) integrated culture of prawn/fish-livestock-crop. Suitable training courses on marine prawn culture will be conducted. For effective implementation, it is proposed to take up the activities under separate research projects.

Development of artificial feed for prawn larvae and juveniles / (CF/CUL/1.2) (Final Report)

M.M.Thomas, M.Vijayakumaran, M.Kathirvel.

This project was initiated in 1973 with a view to formulate suitable artificial feeds with cheap and readily available raw materials to feed the prawn postlarvae and juveniles in prawn culture practices; (ii) to determine their efficiencies in promoting growth of prawns; and (iii) to estimate the conversion efficiencies of the feeds in different species.

Salient findings

Feeding experiments with 19 different types of artificial feeds compounded using ingredients in different proportion of protein and carbohydrate contents indicated that the feed with the composition of 41.67% by weight of fishmeal, 33.33% of tapioca powder, 16.67% of rice bran and 8.33% of mineral supplement gave the best growth rate in the postlarvae as well as juveniles of M.dobsoni and P.indicus. The assimilation efficiency of this feed was 81% with gross and net conversion efficiencies of 39.6% and 49.3% respectively. The intake of feed per day was 12.2% of body weight and the average growth per day was 8.5% of the body weight.

Work done

Nineteen feeds were compounded using wheat flour, ground nut cake, coconut cake, rice bran, fishmeal, prawn meal and mineral supplements using agar-agar as binding agent. The pellets were fed to the postlarvae and juveniles of M.dobsoni and P.indicus kept in aquaria in the laboratory and the growth of prawns were studied. Feeds with different proportions of these ingredients were tried to determine the optimum requirements of carbohydrate, protein, etc., and to find out the best feed for use in commercial prawn culture practices.

It was found that feed No.15 containing 41.67% by weight of fishmeal (Protein: 22.41%) 33.33% of tapioca powder (starch: 18.27%) 16.67% of rice bran and 8.33% of mineral supplement (Fat: 0.91% , Ash:22.54%) with moisture content of 6.4% gave the best growth rate. In M.dobsoni juveniles the growth exhibited was 0.505 mm per day, while in P.indicus juveniles it was 0.565 mm per day in aquarium tanks. The weight increase in M.dobsoni was 0.03 gm per day for 60 days duration. The cost of the best feed was less than Rs.2.00 per kilogram which was cheap considering its energy conversion efficiency.

In order to determine the influence of the size of the container in which they were reared on the growth rate, P.indicus postlarvae were reared in glass aquarium tanks of size 60 x 30 x 30 cm containing 25 litres of sea water and in circular plastic pools of 1 m diameter containing 150 litres of sea water. In these experiments, the postlarvae showed a growth rate of 0.5 mm per day in aquarium tank and 0.6 mm per day in plastic pool.

The energy conversion efficiency of the best feed(No.15) was estimated on M.dobsoni juveniles. Mean and gross conversion efficiencies were 39.62% and 49.34% respectively. The average assimilation efficiency of the feed was 80.99%. The mean trophic coefficient was estimated to be 2.5. The mean consumption rate per day in percentage body weight was 12.16 with a mean growth rate per day in percentage body weight of 8.51. The nitrogen budget was as follows:

	Assimilation: 80.18%			Growth	: 38.79%
Consumption				Moult	: 00.60%
100.00%	Faeces	: 19.82%		Metabolism	: 40.79%

Investigation on salinity tolerance of penaeid prawns (CF/CUL/1.3) (Final Report)

C.Suseelan.

Salt content of the water in which the penaeid prawns live plays an important role in the distribution pattern and their various biological activities. Since information on the salinity requirements of different species of penaeid prawns of our country and on the extent to which they could tolerate the changing salinity conditions is lacking, this project was initiated in 1975 to study these aspects.

Salient findings

Laboratory and field studies on salinity requirements for the juveniles of different species of penaeid prawns indicated that the minimum salinity required for the total survival of P.stylifera and M.affinis was 25‰and 14‰ respectively. M.dobsoni showed a wide range of salinity tolerance, the percentage of survival being 36 at a salinity range of 2-3‰, 74 at 4-5‰, and 100 at 10-11‰ and above. In the salinities below 4‰, higher rate of mortality wasobserved. Juveniles of P.indicus, could although thrive well in salinities as low as 4-5‰, total survival was recorded at a salinity value of 10-11‰, and above.

Work done

The salinity tolerance of juvenile penaeid prawns was studied by a series of laboratory experiments and also by examining the distribution of wild population in relation to different salinity conditions of the Vembanad Lake. In the laboratory, juveniles of M.dobsoni, M.affinis, P.stylifera and P.indicus of almost the same size, obtained from the Cochin backwaters and from the Prawn Culture Laboratory at Narakkal, were reared in seven salinity grades, namely, 2-3‰, 4-5‰, 10-11‰, 14-15‰, 20-21‰, 25-26‰ and 30-31‰ at temperature ranging from 24.2°C to 27.5°C. The distribution of these prawns in relation to salinity in nature was studied on the basis of samples obtained by

the try-net operations at Thevara, Vaikom, Thannirmukom and Pathiramanal in the Vembanad Lake.

Percentage survival of prawns at different salinities in the experiments carried out in the laboratory is given in the following table.

Table: Percentage survival of penaeid prawns at different salinity grades.

Species	Percentage survival at different salinity grades (‰)						
	2 - 3	4 - 5	10 - 11	14 - 15	20 - 21	25 - 26	30 - 32
M.dobsoni	36	74	100	100	100	x	x
M.affinis	0	0	50	100	x	x	x
P.stylifera	0	0	10	15	45	100	100
P.indicus	0	65	100	x	x	x	x

x Experiments were not conducted at these salinities

M.dobsoni (12-50 mm) showed total survival at salinity value of 10-11‰ and above, but in the lesser saline waters than 10‰, their survival rate gradually decreased. M.affinis(15-38 mm) were found to thrive well in the medium having a salinity value of 14‰ and above. In the case of P.stylifera(8-24mm) minimum salinity required forthe total survival was 25‰. Although the juveniles of P.indicus (12-31 mm) would survive the low salinities as 4-5‰, the total survival was obtained in the medium having a salinity value of 10-11‰ and above.

The distribution of different species of penaeid prawns in the Vembanad Lake in relation to salinity during the period of study was as follows:

Centre	Salinity range (‰)	Species
Thevara	19.42 - 26.26	P.indicus
		P.semisulcatus
		P.monodon
		M.dobsoni
		M.affinis
		M.monoceros
		P.stylifera
Vaikom	3.83 - 16.13	M.dobsoni
		M.monoceros
		P.semisulcatus
Thannirmukom	2.76 - 14.45	M.dobsoni
		M.monoceros
Pathiramanal	1.10 - 2.64	M.dobsoni

From the above investigations, it was concluded that among the penaeid prawns studied at present, M.dobsoni and M.monoceros were found to be relatively more euryhaline, followed P.indicus, P.semisulcatus, M.affinis and P.stylifera. The latter three species required a minimum salinity of 10‰ for normal life activities.

Assessment of stomatopod resources

Substantial quantities of stomatopods are landed by the mechanised fishing vessels. Although they form a good raw material for reduction into fish meal, poultry feed and manure, the resource is not fully utilised at present. To better their commercial prospects through an assessment of the magnitude of the exploited resources and study of their relative abundances, biology and population characteristics, this project was initiated in May, 1977.

Work done

Cochin and Neendakara were selected for collecting statistical data on stomatopod landings and samples for biological studies.

The estimated catch of stomatopods landed by the mechanised fishing vessels operating at Cochin and Neendakara during May - August was 66 and 85 tonnes respectively. There were no significant landings from September to December. The fishing was constituted by a single species, Oratosquilla nepa. The size of the species ranged from 50 to 105 mm in the fishery at Cochin and from 61 to 100 mm in that at Neendakara, Larger specimens were caught mainly in May. Females dominated the catch in all these months.

Work contemplated:

The projects will be continued in 1978.

MOLLUSCAN FISHERIES DIVISION

Resource survey of commercially important Molluscs (MOL/RE/1.1)

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Salient findings:

Resource survey of commercially important molluscs along the east and west coasts of India covering a distance of 260 km. was completed. In some localities estuaries and backwaters were also surveyed. The investigations brought to light the existence of extensive beds of Donax spp. in the sandy intertidal region, Perna spp. in the rocky intertidal region and Meretrix spp. and Katelysia spp. in estuaries and backwaters.

Work done:

CALICUT: At Calicut, 35 km stretch from Kappad to Beypore was surveyed. The inter-tidal region here is characterised by scattered rocks too. Edible oysters (Ostrea cucullata and Crassostrea madrasensis) were encountered from Korapuzha to Puthiappa.

Regular observations were made for the estimation of the green mussels exploited from the natural submerged mussel beds from Calicut to Thikkodi. Estimated monthly landings of the green mussels along the three important zones, Calicut to Elathur, Quilandy to Moodadi and Nandi to Thikkodi showed that the landings were better during the months January to April and also October.

Donax spp. were uniformly distributed along the sandy shore of the surveyed zone. Rich beds of Meretrix meretrix in the Korapuzha estuaries is an important observation. Thick beds of marine mat forming mytilid Mytilaster arcuatula were noticed in Korapuzha estuary. A fishery for these weaving mussel exists during April-June period.

Vizhinjam: A coastal stretch of 65 km from [illegible] Thumba was completed. Occurrence of dead shells of Donax sp. Perna spp. Cardium spp. Trochus spp. Cypraea spp. and Architectonin spp. and their collection for manufacturing lime is a common feature along the coast. Dead shells of pearl oysters around Muttam area is an important observation. The thick and extensive beds of Sanguinolaria elongata occur over five hundred metre area in the backwaters of Pachellur Pozhi.

A preliminary survey carried out in the Neendakara area revealed a good settlement of the green and brown mussel at the port area. At Dalavapuram a good bed of edible oyster was noticed which is being regularly exploited by local fishermen. Villorita and Meretrix beds were noticed in Neendakara backwater area.

Tuticorin: During the early part of the year the chain of coral islands, in the Gulf of Mannar from Tuticorin to Pamban were surveyed for edible and commercially important molluscs. Of the 20 islands surveyed, Donax spp. population existed in the sandy beach of almost all the islands except one or two. Unlike the mainland it was very sparse in distribution. But the most abundant clam was Mesodesma glabratum especially in the southern islands. Gafrarium tumidum was very common in Manoli island while Pulli and Pullivasal islands were characterised by extensive beds of Arca spp. Survey of inter-tidal region from Tuticorin to Keelakarai was completed which brought to light the presence of extensive beds of Donax spp. (maximum of 552 nos. per m2) in thesandy beach of Mundal area. Valinokkam beach is characterised by rocks. Ostrea cuculatta (15 nos. per sq.m) along with the weaving mollusc Modiolus spp. is a common occurrence here.

With this the first phase of the resources survey of commercially important molluscs i.e. survey of intertidal region, of the zone Cape Comorin to Keelakarai, a coastal stretch of nearly 300 kms., has been completed.

Mandapam Camp:

During the year ending December 1977 the edible molluscan resources in the surface zone of intertidal region at 79 stations on Palk Bay side from station 99 at Alagankulam to station 177 in the Gulf of Mannar side from station 41 at Vedalai

upto station 180 at Keelakarai Boat Jetty were surveyed.

On Palk Bay side the clam, Donax incarnatus was found in densities of 38 to 167 per sq.m. at station 99 to 109 and 111 to 117. Seed clams of the species were also found in large numbers of 200 to 1600 per sq. m. at the above stations. The species was found in small numbers of 12 to 24 per sq m. at stations 119 to 123, 136, 139 and 140. Donax cuneatus was found in small numbers at 137, 139, 140 and D.faba in stray numbers at station 139 to 141. At stations 129, 130, 132, to 136 and 138 to 143, Umbonium vestiarium were recorded in good to huge densities of 502 to 8600 per sq. m. From station 144 to 177 edible molluscs were not present.

On the Gulf of Manner side Donax faba was found in small to moderate densities of 4 to 45 per sq. m. at stations 42 to 52. Seed D.faba occurred sporadically at stations 44, 45 and 47. From station 57 at Seeniappadarga to station 180 at Keelakarai Boat Jetty, the clams belonging to a single species D.cuneatus were found at a number of stations in small densitites of 2 to 29 per sq. m. At station 155 near Sethukarai the density of this species was 57 per sq m. Seed clams of D.cuneatus were also recorded in small numbers alongwith adults in most of the stations. Umbonium vestiarium was recorded only at station 48 in Gulf of Manner at a density of 790 per sq. m.

MADRAS:

The sandy inter-tidal area between Palavakkam and Puzhiuthivakkam was studied. Donax cuneatus and Paphia textile are the bivalves present in the area. The bed of Donax cuneatus occur throughout the coastline while Paphia textile was found very rarely and did not form beds in the intertidal area surveyed. The number of Donax cuneatus and Paphia textile present in 1 sq. m. area varied from 0-43 and 0-4 respectively. The average number of bivalve present in 1 sq. m. was noted and from this the existing population of bivalves in the zone was estimated to be 569000 in number.

Survey of Adayar estuary was also initiated and it revealed the presence of only dead shells of clams like Katelysia and Meretrix and gastropods like Cerithidia and Umbonium. At present these are exploited for the manufacture of lime.

KAKINADA:

The survey of window-pane oyster resources in the Kakinada Bay was completed by March 1977. The data were processed and the following results were obtained.

1. It is estimated that there is live window-pane oyster population of 8945.3 tonnes in the bay.

2. There are 43,847.6 tonnes of shells of P.placenta in the bay.

3. The live oyster is confined to the western and southern sides of the bay which are known to be relatively more productive with the bottom being fine clay.

4. Specimens of P.placenta measuring less than 30 mm (spat) were recorded from some northern and western stations in the bay during March-May period.

5. The shells of dead oyster are spread all over the bay with very large concentration on the eastern side.

6. It is estimated that about 51 tonnes of live window-pane oyster from Kakinada Bay would be necessary to yield one kilogram of pearls which are priced at Rs. 5000/-.

The fishermen catch window-pane oyster available on the southern and western sides during January-May and the catches are utilized mainly for manufacture of lime. It is suggested that extension of fishing season along with extension of fishing ground to the eastern and Central portions of the bay will result in greater yield of this resources. It is also suggested that extraction of pearls and utilization of meat of this oyster as food would augment the income of the fishermen without in any way affecting the usual production of lime.

WALTAIR: Survey of 40 km stretch from Waltair to Annavaram was completed in 1977. Submerged rocky areas were also surveyed which revealed the existence of Perna viridis, Meretrix sp. and Modilus sp. Rock oysters (300 to 400 per sq.m.) were encountered near Moolapalem- Rendugullapalem area. Rock oysters and some gastropods like Turbo intercostilis, Cypraea spp. etc. were noticed on the rocks of Vishakapattinam outer harbour. A few numbers of Pinctada spp. (P.chemnitzii) Perna viridis and Modilus were seen on the rocks of Dolphins-nose(Yerada) and Gangavarma coasts. Survey of 40 km. stretch Nagamayapalem backwate area revealed the existence of Meretrix beds.

PORTONOVO:

Survey on the seasonal abundance of the stocks of the back-water clam Meretrix casta and Katelysia opima in Vellar estuary was done in detail. The results showing the estimated stock in various months and distributions per hectare are given below:

	Total stock in m. tonnes		Distribution per hectare in m. tonnes	
	M. casta	K.opima	M.casta	K. opima
January		No data		
February	7050	103	20.14	0.30
March	5339	296	15.25	0.85
April	1200	163	3.43	0.47
May	1369	149	3.91	0.43
June	2086	101	5.93	0.29
July	1970	98	5.17	0.28
August	2887	127	0.20	0.36
September	3467	204	9.91	0.58
October	No data could be collected due to the monsoon flood in the estuary			
November				
December	Entire clam beds were washed away by the unprecedented flood in the estuary during the cyclone.			

Other characteristics of the resources like length composition, maturity, sex ratio and percentage edibility were also studied in details. Environmental data like salinity and oxygen were also collected.

The total landings of clams during the year was 582.Mt. The method of fishing was by hand picking. The catch rate was much better during the months July to September.

Investigations on the Cephalopod Resources(MOL/RE/1.2)

E.G. Silas, M.V.Jadhav, Kuber Vidyasagar, M.M.Meiyappan, K.Prabhakaran Nair, K.Satyanarayana Rao, P.V.Sreenivasan, R.Sarvesan, Y.Appanna Sastry, B.Narayana Rao.

Salient findings:

An estimated 9266 tonnes of Cephalopods were landed during 1977, mostly by shrimp trawlers. The catch had decreased by about 14.4% over that of 1976. Kerala accounted for 53.7% followed by Tamilnadu 14.8%. There was no organised fishery for Cephalopods except at Vizhinjam. The centrewise investigations on this resource are as follows:

VERAVEL:

Sepia aculeata and Sepiella inermis were the dominant species, though Sepia pharaonis, Loligo duvaucelli, L.edulis and Lolliolus investigatoris were present in lesser quantities. S.aculeata: Size range 61 to 175 mm. The size at maturity 77mm in females, 60 mm in males. S.inermis: Size 62 to 70 mm. Size at maturity 40 mm in females and 33 mm in males. In both the species the gut content analysis showed the presence of fish and crustacean remains.

BOMBAY:

Estimated landings at Kasara Bunder 321 tonnes and at Sasoon docks 173 tonnes. The dol net catches at Versova were very poor. The landings at Sasoon docks showed a decrease of 13.3% and at Kasara Bunder an increase of 19.6% over that of 1976. S.aculeata and L.duvaucelli were the dominant species. S.aculeata: Size 41 to 214 mm L.duvaucelli: 16 to 240 mm. Gut content studies showed the presence of fish, crustacean and cephalopod remains.

COCHIN:

Estimated landings by shrimp trawlers at Fort Cochin landing centre 132.3 tonnes (@ 0.47 kg/h). Peak catches were in October which accounted for 62.3% of the total cephalopod landings. Cuttle fishes accounted for 56.2% and the rest by squids. Cuttle fishes accounted for 56.2% and the rest by squids. S.pharaonis: 26.6 tonnes. Peak in October. Size 94 to 173 mm. Mature gonads were noticed in April. 72% males. S.sculeata: 12.3 tonnes. Size 90 to 156 mm. 55% males. Mature gonads were noticed in January. S.elliptica: 18-3 tonnes. size 59 to 111 mm. 45% males. Mature goneds were noticed in February, April, October and November. S.inermis: 17.0 tonnes Size 39 to 96 mm. 49% males. Maturing (Stage II) goneds were dominant. L.duvaucelli: 58.0 tonnes. Size 48 to 196 mm. Males 53%. Mature gonads in January, February, March and October.

VIZHINJAM:

Estimated landings 146.3 tonnes - of which 90% were by hooks and lines and the rest by boat and shore seines. The catch showed about 36% increase over that of 1976. S.pharaonis and L.duvaucelli were the dominant species. The peak catches were in September. S.pharaonis: Size 80 to 330 mm. About 70% were in 180-250 mm range. Males above 190 mm and females above 215 mm were in 180-250 mm range. Males above 190 mm and females above 215 mm weremature. Gut content analysis showed that about 50 of the contents were of squid remains. This species accounted for 72.3% of the landings. L.duvaucelli Size:Males 30 to 330 mm Females 30 to 180 mm. Size at maturity- Males - 130 to 140mm and females - 105 mm. Fish remains were the dominant food item. L.Singhalensis: Size - Males 70 to 160 mm and females 50 to 110 mm. Size at maturity Males - 90 mm and females 100 mm.

Portonovo:

16.2 tonnes by shrimp trawlers. Peak catch was in July. S.inermis was the dominant species. Its size ranged from 20 to 90 mm Juveniles were occurring in the catches in April. S.sculeata: size range 30 to 161 mm.

MADRAS:

65.7 tonnes by shrimp trawlers at Kasimode base. Cpue 0.53 kg/h. The catch showed a substantial decrease from 205 tonnes of last year. Peak catch in May. Squids formed 56% of the catches. Biological observations were made on all available species During this year there were landings by indigenous gear 'Thuri vala though in small quantities.

KAKINADA:

256.8 tonnes by shrimp trawlers. This year a significant increase was noticed in effort as well as catch. The catch increase was about 25% over that of last year. Peak catches were in May S.aculeata was the dominant species contributing 50.5% of the cephalopod catch- Its size ranged from 15 to 165 mm. All the specimens were in mature condition in September to November period. L.duvaucelli ranged from 35 to 145 mm. Most of the specimens were in maturing and mature condition. S.inermis ranged from 15 to 115 mm. Mature specimens were at large during November -December period.

Work done:

Catch, catch per unit of effort-gearwise/monthwise/ specieswise were estimated at all centres. Biological characteristics of all important species were investigated.

Work contemplated: Since the project is to be continued upto 1980 the work will be continued on the above lines.

Investigations on the Pearl oysters(MOL/RE/1.3) / and chanks

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Pon Sirsimetan and A.Sreenivasan, K.Satyanarayana
Rao, P.Natarajan, Ashok Kumar Unnithan D.Sivalingam,
K.K.Appukuttan, T.Prabhakaran Nair, Radhakrishnan and
P.V. Srinivasan.

The commercial Chank Fishery in the Gulf of Mannar was greatly affected because of the disputes between the divers and the government. While the southern area from Tuticorin to Tiruchendur was left unexploited Mandapam-Keelakaral zone was fished by the Lessee. The Palk Bay fishing was carried on as usual.

Diving observations made for the presence of pearl oyster spat population revealed that spat fall had been patchy and more evident on the inner series of pearl banks. During the year two aqualungs and a few diving accessories were imported from United Kingdom.

The salient features of the work are summarised below.

TUTICORIN:

(Pearl Oysters) Extensive aqualung diving and skin diving operations were combined with special island survey work all along the Gulf of Mannar coast. The seaward side of 20 islands were inspected to show the possibility of spat settling down and thriving in the shallow reef areas and adjacent seaward rocky bottom. Except for an occasional spat of Pinctada fucata in the four islands in the vicinity of Tuticorin the rest of the areas were found completely barren of oyster settlement.

The rocky bottom of Valpar at 14-16 mt. depth, represented by Devipar, Pernandar paar, Cruxian Paar and Karai Paar, showed the presence of oyster spat population ranging in density from 5 to 7 per sq. mt. The size range of the spat was 25-40 mm. The rocky bottom between Tuticorin to Pinnakayal showed a similar pattern so far as the inner series was concerned. Those lying at depth range 20-22 mt. however, were mostly barren except Tholairam Paar area where oysters of size 35-45 mm were present in small numbers (1-2 per sq. mt.)

The competing fauna namely Modiolus species was evident in all areas especially on the inner series which did not augur well for the healthy growth of the existing oyster spat in these areas.

Chank Fishery:

MANDAPAM CAMP:

Kannirajapuram Fishery: The previous chank fishery which commenced in October 1975 was continued till the end of January 1977. The total landings of chanks by diving were estimated to be 613143 during the above period. The size range of chanks was 91-205 mm.

The present season commenced only on 11th December '77. During the year under report 1,86,927 chanks were landed 18,929 chanks were wormed by Cliona. Out of these wormed chanks 1332 were wormed by Lithophagus sp. also. The size range during the year was 95-205 mm., the dominant size being 105-135 mm. Accompanying table shows chanklandings at different centres. (Table 8)

KEELAKARAI:

The size varied from 36 mm to 258 mm. The majority was X.pyrumver acuta. There was no landing of chanks throughout the last two months of last quarter. More landings of chanks were recorded during the second quarter. Cliona sp. and Lithophaga were the common foulers found in the chanks.

Chank fishing by diving was carried out at Vedalai from January to June 1977 around Musal Island and Mansull Island and a total of 678 chanks were got in the period. 288 chanks were obtained by divers in the quarter July-September and 236 chanks in December. All the chanks belonged to the variety acuta. 1402 chanks were landed at vedalai in the year.

The chank fishery commenced at Rameswaram in the first week of March 1977 and extended till the middle of May. 24,358 chanks were got by diving in the season at Nadu paar, Vaada paar, Konda paar, and Manalkadal by divers who came from Keelakarai, Periapatnam and Vedalai. Later in the year chanks were got by

diving only in small numbers by fisherman who went for fishing sea cucumbers, visibility being poor due to turbidity. The total chank catch in 1977 is only 42.4% of that in previous year which was 59,412. This is due to the sea being turbid even at the beginn of the fishing season, ie March-April. Further, there was no fishing of chanks from October to middle of December due to ban imposed by Tamil Nadu Government on fishingof chanks.

Chank landings in 1977 was nearly double the quantity of chanks landed during 1976 at Devipatnam. The increase in the catch during 1977 was due to the intensification of diving operations by employing more canoes and divers, compared to the preceding year. Analysis of the length frequency distribution of chanks in different months showed that during April, May, June and July, 111-120 mm was the dominant size group. During August and September 101-110 mm was the dominant group. Chanks of the size group 81-90 mm were landed only during May and September. Chanks belonging to the size group 151-160 mm were rare and were present only in May 1977.

Mullimunai Fishery:

Eventhough the chank fishery commenced earlier, it was active from April 1977. During the first quarter, the chanks caught in 'Thalluvalai' was the main source of chank landing. There was good landing of chanks in April as the sea was very clear and calm most suitable for diving. In May and June the landings dwindled due to turbidity. The fishery declined gradually from July. It was active upto August and diving was limited to a few days in September. Chanks caught in 'Thalluvalai' were landed in small numbers. The size range was 90-200 mm, the dominant size being 130-160 mm. In September bigger chanks of 170-200 mm were dominant.

Karangad Fishery:

The fishery was similar to that of Millimunai. During the first quarter crab net and 'Thalluvalai' landed chanks in small numbers. The fishery was good in April and the chanks were caught by diving. In the third quarter, all the divers went out for 'Thalluvalai' fishing. So chanks got entangled in crab nets were landed in small numbers.

Thondi:

During the period ending December '77 9712 number of chanks were landed; The size range varied from 32 mm to 252 mm. The majority was x. Pyrum var obtusa.

Sethubavachatiram:

The first quarter registered the maximum catch of full size chanks. Cliona sp and Lithophagus sp were found to be common foulers of chanks landed in all the three centres. Edible oyster spats were fould attached in certain chanks landed at Thondi during the first quarter.

VIZHINJAM:

Oyster survey:

Mulloor, Enayam and Colachel were covered for Pearl Oyster survey work. The rocky patches 1-2 kms away from shore area were surveyed and it was found that Pinctada fucata and P.chemnitzi were available in these areas. Specimens ranging 26 to 121 mm also were collected. At Muttom area also there was good settlement of Pearl Oysters. During March to April settlement of young pearl oysters was noticed at Vizhinjam bay. Artificial settlers, viz., split nylon ropes were used to study the settlement pattern. Number of oysters were found attached to these settlers and also in the mussel ropes suspended in the rafts. In April there was good settlement of Pearl Oyster spats over the seaweeds of the bay area.

Chank Fishery:

Chank landing survey was done at selected centres viz. Quilon, Varkala, Vizhinjam, Kuttiandi, Enayam, Kolachel and Kadiapattinam. and poor during February and March. During the last quarter the chank landings at Vizhinjam, Veli, Varkala, Enayam, Colachel and Kadiapattinam were high, (during December) since the water was clear for diving. It is understood that 20-25% of chanks are either damaged or wormed. The percentage of chanks were above 6th group was between 30-40. They are sold for Rs. 3 to Rs. 5/- by fishermen. An approximate total of 15,000 to 18,000 nos. were landed during 1977 at all these centres. At Vizhinjam, the hooks and line fishing of chanks have not started during December.

PORTONOVO:

A total of 49380 chanks was landed at Portnovo by mechanise vessels during the year 1977. This was worth of Rs. 64128 at the local market. The maximum landings were in May when 40.65% of the total annual catch was landed, which was due to the increased fishing pressure. At Portonovo, the normal practice is to return the undersized (below 50 mm diameter corresponding to 90 mm length) to the sea from the boat itself, but some fishermen bring them to shore to sell for making lime.

Table 8

Details of Chank landings at different centres

Centre	Full size	Under size	Wormed	Total
Kannirajapuram	160381	9617	18929	188927
Keelakarai	6412	440	635	7488
Devipatnam	14738	1086		15824
Mullimunai	18951	1131	2501	22583
Kerangad	13545	1018	1082	15245
Thondi	7419	890	1403	9712
Sethubava-Chatram	2476	254	437	3173
Vedalai	1292	5	105	1402
Rameswaram	21949	706	2622	25277
Porto Novo				49380
Vizhinjam				15000

Pearl Oyster Atlas (MOL/RE/1.4)

K. Nagappan Nayar, S. Mahadevan, and A.Bastin Fernando

Collection of chronological details of Pearl Oyster beds inspection conducted in the Gulf of Mannar and Palk Bay was completed during the year and detailed tabular statement showing the history of each bed from 1847 was completed. The structure and composition of the Oyster shell and pearl, early history of pearl culture and experiments connected therewith together with the present day technological advances were gathered. Editing the above details into a dummy to form the part III of the atlas is in progress. It is hoped that this would be completed by the middle of 1978.

Based on the suggestion received towards the improvement of pictorial representations of the Part I and II of the dummy, alterations were made.

Project: Mariculture - Culture of Edible Oysters (MOI/CUL/1.1)

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Salient findings:

During 1977 extensive culture of Crassostrea madrasensis was undertaken in Karapad creek at Tuticorin and Vaigai estuary near Mandapam Camp. The accent was on the collection of oyster spat from natural beds by setting up different types of spat collectors at different seasons. The spat fall on the gulf was very poor during the year. This was supplimented by extensive collection of spat which had settled down over the natural beds also. The technique of spat collection was successfully standardised at Tuticorin by employing lime-coated and cement coated tiles for collection during oyster spawning seasons.

Growing oysters by the rack culture method was tried at Tuticorin. A stock of 30,000 oysters of different size groups collected from the natural ground were grown. The growth pattern of the cultured oyster spat appears to be influenced adversely by silting, overcrowding and fouling. The work at Vaigai estuary near Athankarai did not meet with much success due to unexpected floods in the estuary during North-East monsoon period.

Work done:

Mandapam Camp:

The cultured oysters which were shifted from Vaigai Estuary at Athankarai in the last quarter of 1976 due to prevalence of low salinity conditions in the estuary were reared in the inshore coastal waters of Gulf of Mannar near CMFRI Jetty, Mandapam Camp till March 1977. In the inshore coastal waters the cultured oysters showed a growth of only 2 to 3 mm per month in the first quarter of 1977. In April

the cultured oysters were re-transferred to the estuary on the salinity reaching 29‰. A model size of 65 mm of Crassostrea madrasensis seen in March, 1977 did not show a shift in June. The maximum size of oysters increased from 78 mm in December 1976 to 86 mm in March 1977 and 96 mm in June 1977. In March 1977, three oyster culture racks were installed in Vaigai Estuary at Athankarai and one hundred oyster collected from Kanchirangudi, Karangad and Sundarapandipattinam were reared in Vaigai Estuary in trays. In addition 7085 oysters, 30-90mm in size, were collected from Vaigai Estuary and reared in trays kept on four additional racks. There were a total of 9085 oysters in the oyster farm at the end of June 1977 and 14,950 oysters in the month of October 1977. The oysters were regularly cleaned and fouling organisms like sponges, barnacles, weaving mussels and algae were removed. The modal size which was at 65 mm in June 1977 increased to 85 mm in September 1977. The maximum size of cultured oysters increased from 96 mm to 120 mm during the same period. Concrete piece, tile and oyster shell cultch were kept in the estuary for setting of oyster spat. Spatfall on cultch was very poor during the year. There was setting of one to three spat on the valves of some of the cultured oysters.

In the third week of October, 1977 there were sudden floods in Vaigai estuary following very heavy rains and discharge of water from upper reaches of river and numerous irrigation tanks. As a consequence, low salinity of 0.23‰ to 0.46‰ was observed continuously. Removal of oysters from the estuary was obstructed by rain and swift flow of water. 2500 oysters could be saved from the trays by diving and these were reared in trays on racks in inshore waters of Gulf of Mannar near C.M.F.R.I. Jetty. Between November and December, 1977 the oysters showed a growth of 10 mm in size. Data on increase in weight was recorded. Rainfall and opening or closing of the far mouth influenced the salinity ofthe estuary.

The hydrogen ion concentration (pH) also showed

monthly variation. The maximum values were noticed during Oct-Dec. period and the minimum values were noticed in January and February.

Qualitative and quantitative study of the stomach contents of the oysters was carried out from May 1977 to December 1977. The important food items which were present in the stomach of the oysters during the period of study included Navicula, Nitzschia, Pleurosigma, Coscinodiscus, Thallassiothrix, Rhizosolenia, Chaetoceros etc., in the order of preference.

Quantitative study of the stomach contents showed that Nitzschia constituted the dominant food item in July, whereas Navicula showed dominance in June, August, September October and November. In May Pleurosigma was the dominant food item. Corcinodiscus formed the maximum percentage in the stomach in the month of December, during which period the oysters were reared in sea in the inshore region. Nitzschia, Navicula, Thallassiothrix, and Coscinodiscus were represented in the stomach contents during all the months under observation.

Epifauna associated with the oysters in the culture trays and natural beds included the barnacle Balanus, hermit crabs, aphids, Modiolus, Chiton, Thais sp. Polychaetes, amphipods, sponges etc. Presence of Modiolus and alphids was more in natural beds than in culture trays. Large scale encrustration of barnacle was noticed on the poles erected for holding the culture trays in the estuary.

Epiflora associated with the oysters included Chaetomorpha, Cladophora, Ceramium, Polysiphonia, Ulva lactuca etc. A number of oysters transplanted from Kachirankudi estuary, which were grown to one and half years old were observed to have been infected by the boring sponge Cliona.

Tuticorin

Experiments on the large scale collection of edible

oyster spat by employing roofing tiles as collectors have been carried out during the period under report. The tiles used as spat collectors measured 18 x 10 cm and are about 10 mm thick. Both lime coated and cement coated tiles were used.

Before lime coating, all the tiles were thoroughly brushed with sea water and dried in wind. A double coat of lime was given to each tile so as to render easy scrapping of the spat later.

Over and above the double coat of lime a thin coat of cement was given and these tiles were branded as cement coated tiles.

Before putting out the tiles they were stacked together in pairs in nylon-meshed iron cages. 20 such cages with 50 tiles each were placed on the rack erected in the Karapad creek.

During the month of July totally 3000 tiles were laid out for spat settlement of which 450 were cement coated. From the month of September onwards 1000 lime coated tiles were laid out for spat settlement. First set of spat settlement on the tiles was noticed on 23.8.1977. Thereafter, almost in all the months spat settlement on the tiles was noticed. However, the incidence of spat settlement varied during the months. The average incidence of spat settlement was found to be the highest during September both in lime coated (34 nos) and cement coated (44 nos.) tiles.

Eventhough an average of 34 and 44 spat were noticed on the lime and cement coated tiles respectively a maximum of 62 on lime coated tiles and 80 on cement coated tiles settled during the month of September 1977 is quite encouraging. The concave side of the tiles favour good settlement. Settlers including fouling organisms were practically nil on the convex side. Based on the average incidence of spat settlement it has been estimated that, at present, totally 54,500 spat are available in the farm.

Scrapping of oyster spat from the tile collectors was

resorted to during the month of December 1977. Scraped spat were segregated according to the size range and stocked in box type cages which were suspended from the racks in the open sea.

Observations on the growth rate of seed oysters on the tile collectors were also made once in a month. Length frequency studies revealed that the average monthly growth rate of oysters in the farm area was 15 mm. Various factors seem to influence the growth pattern of the oysters spat on the tiles. Fouling by barnacles and silting were found to endanger the settled spat.

Experiments were also conducted during the month of August 1977 by suspending strings of cocoanut and oyster shells (Cultch). The coconut shells were coated with lime and suspended from a casuarina pole with a series of 10 to 12 shells leaving a gap of 7-10 cm. between each shell. Small wooden pieces were used to hold the shells in proper places. Both in coconut and oyster strings that were observed during the month of September 1977 the attachment of spat was very stray.

During the month of October, a simple method of spreading the oyster shells over the rectangular cages was initiated. 5 to 26 spat with an average of 7 spats per shell were noticed in these shells. The same method was followed, during November and December and average spat 2 and 0.4 were noticed respectively.

The oysters with the cultch was allowed to grow in clusters. Observations on the growth rate of seed oysters on the oyster shell collectors were also made. The average growth observed was 17.8 mm, 10.2 mm and 10.1 mm for the months of November, December and January 1978 respectively. Since the seed oysters were allowed to grow in clusters various factors such as fouling, silting, overcrowding were found to endanger the growth of oysters.

During the period under report, investigations on the biology of the oysters in the farm were made. Total

weight of the oysters, length, flesh weight sex and gonad conditions were recorded.

The flesh weight of the oysters, monthly change of the flesh weight, modes occurring and average weight were recorded. Growth studies on edible oysters in the farm were continued.

Though different methods of induced breeding of the oysters were tried, only stripping method was successful. Altogether twenty stripping experiments were conducted. Ripe male and female oysters were selected as breeders from the ntural bed situated in the Karapad creek. The eggs were isolated and fertilized in separate containers. The different developmental stages were observed and both photomicrograph and camera lucida drawings were made. The average time taken by a fertilized egg to reach the different developmental stages was determined. Since the development of the larvae was much hindered by the protozoans which multiply tremendously in the culture medium antibiotics like chloromphenical, streptomycin sulphate and pencillin were used. The optimum concentration of the antibiotics required was found out. To boost the growth of the larvae multi vitamins were used. Tetraselmis was given as food for the larvae. The larvae which attained the straight hinge stage survived upto 19 days. Since tetraselmis alone was given as food the larvae did not show any appreciable growth in size.

Investigations were conducted on the infection by parasitic larval Cercaria in the edible oyster. The parasites were isolated and identified. The effect of the parasite on the host especially on its sterility and change in flesh weight were observed.

Culture of Mussels (MOL/CUL/1.2)

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and K.K.Appukuttan.

Salient findings:

Feasibility of culturing green mussel and brown mussel was established in 1976 at Calicut and Vizhinjam research centres respectively. This work was further intensified in 1977 with the object of standardising the techniques of culture and studying the economic feasibility of open sea mussel culture. The outstanding feature of this year's work has been the success in growing green mussels at Calicut where it has been shown that it is possible to produce 428 tonnes/hectare of green mussels within a short period of 180 days. This is thrice the yield reported from foreign countries like Spain. At Vishinjam also observations have proved that the brown mussels can grow four times its weight within a period of 365 days with a reasonably fast growth rate. The investigation on open Sea mussel culture have shown that it is possible to grow the mussels to marketable size during the Pre and Post monsoon seasons and abundant collection of seeds can be made by laying special spat collectors.

Work done:

Calicut

Large scale culture of the green mussel (Perna viridis) was carried out in the open sea at Calicut and significant results were achieved. Ten rafts each of size 7 x 6.5 metres were floated in the open sea in the last week of October 1976, with a view to studying the production rate, economic feasibility and perfection of the techniques.

The rafts were constructed using teakwood and bamboo poles and were mounted over oil barrels of 200 litres capacity (8 barrels for one raft). The area covered was 450 square metres at 9 metres depth, situated 4 kilometres away from the shore. "Warning winkers" were installed on the rafts to

demarcate the farm area in the sea against possible navigation hazards.

Seed mussels for the culture work were collected from the natural mussel beds near Valathur. Average length of the seed at the time of transplantation was 21.1 mm. weighing 0.69 gm. Seeds were cleaned properly to remove fouling organisms before transplantation. Four kilograms of such seeds were securely wrapped round each rope of 8 metres length and suspended from the rafts about one metre apart. Both nylon and coir ropes of 14 mm. and 20 mm. respectively were used for seeding the mussel spat. Altogether 533 ropes seeded with juvenile mussels were suspended from the rafts. The seeding part of the culture work took two months time (November and December).

The growth of the seed mussels on suspended ropes in the farm was very rapid. Seed mussels having an average length of 21.7 mm. weighing 0.69 gm. transplanted in the first week of November 1976 grew to a size 89.22 mm. weighing 30.03 gm. in the first week of May 1977. The average growth rate was about 12 mm. per month. Average meat-weight of the seed was 0.27 gm. (forming 39.13 percent of the total live weight) which increased to 15.73 gm. at the time of the harvest in May 1977, registering 52.28 percent of the total live weight. The growth rate ofthe seeds in the natural bed was noticed to be slow.(8.1 mm. per month). Meat yield from the natural bed mussels in May 1977 was only 39.6 percent of the total live weight.

One interesting observation made in the present study relates to the early development of the gonads in case of cultured mussels. Seed mussels transplanted from the natural beds to the culture farm showed signs of gonad development within a period of 30 days. Within 60 days, the gonads of all the mussels in the farm had attained sexual maturity. Spawning started after 90 days and over 50 percent of the mussels was found to have spawned before March 1977. Heavy settlement of the spat was noticed all over the suspended

ropes. In the case of mussels in the natural bed, gonad development commenced only in May 1977 and spawning was not observed till the second week of August.

Harvest was begun on 30th April and completed on 15th May 1977. Due to strong winds and wave action, on 16th April 6 rafts were damaged 357 ropes suspended from these rafts were completelylost in the sea. Visiting the farm site for 7 days was not possible to try harvesting the mussels from the damaged rafts. The remaining 176 ropes harvested from 4 rafts yielded 6164 Kg. of mussels. A part of the harvested mussels were sold to local merchants at the rate of Rs. 30/- per gunny bag (about 100 kg.) and the remaining to a local canning factory at the rate of Rs. 7/- for 100 mussels, totalling an amount of Rs. 1447/- for the whole harvest.

It is observed that 4 kgs of mussel seeds transplanted on 8 metres length rope in November 1976 produced 35 kg. of mussels within 6 months. This showed that one metre length of rope can produce 4.4 kg. of mussels. Thus it is clear that 1 kg. of mussel seed can be grown to more than 8 kg. of mussels within a period of six months. The percentage meat yield of cultured mussels being 52.38, the average meat yield from one metre length of rope within six months is about 2.4 kg. Calculating on this rate of production the yield from one hectare by suspended culture method in the open sea for a period of six months amounts to 428 tonnes.

Vizhinjam:

There were 117 ropes of different length, both coir and nylon, suspended from 3 rafts. The number of mussel settled over a unit area in the rope was studied by taking samples from uniform length of ropes regularly. It was found that the number of mussels per 1 metre length ranged from 78-204. The cultured mussels reached harvestable size by May (55-59 mm) and they started spawning from June. Artificial cultches made of coconut shell, tiles and bamboo splits were released in June. The settlement of mussel spat over these cultches were very poor. As noticed in the natural bed

there was a heavy spat fall of Modiolus sp in the area also. Right from September seeding work was initiated. Young mussels ranging from 15-25 mm were collected and 18 ropes were released during this period.

Due to unfavourable weather conditions seeding work could not proceed during October. By the beginning of November 25 ropes were also seeded. The seeds used per meter varied from 1.5 - 2 kg. This year there was heavy rainfall during October and November and there was heavy influx of freshwater in the bay. Due to sudden change in environmental condition the seeds in the ropes started falling off from the rope and young mussels attached to the seeded ropes died showing heavy mortality. In all the 43 ropes settlement was very poor. Most of the ropes were taken out and seeded again.

Initial works on open sea mussel culture was started by October. Two rafts of 6 x 6 m diamension were fabricated. The rafts were anchored 2.5 km. away, opposite to the inspection bungalow at a depth of 20 metres. 36 ropes were suspended in these rafts. The rope length ranged from 7-9 metres.

The availability of seed mussel was much less, since the settlement in the natural bed was very poor. Of the old stock of cultured mussels 40 ropes were utilised for biological studies. Six ropes were used for various exhibitions locally as well as at Cochin. After June the mussels started falling from the ropes due to heavy weight. The remaining mussels were estimated approximately at 1500 kg. The average weight of mussel per meter varies from 12-15 kg.

Biological studies of cultured brown mussels were taken from ropes regularly to study the growth rate of mussels in the bay. The studies showed that the species had grown 35 mm during 12 months period with an average growth of 2.9 mm per month. Analysis of the complete growth data of the year showed that top portion of the ropes recorded higher size and flesh weight as noticed in the previous year. The maximum percentage of flesh weight was in July (47.58%). A corresponding change in the condition index also was noticed

with the minimum in August and maximum in July.

Mature specimens of mussels (60-70 mm size) started spawning in laboratory condition during June and the spawning lasted till the end of August. The mature specimens liberated eggs by giving 'stress' and the eggs were mixed with sperm in filtered sea water. Free swimming Veliger larvae were transferred to big Aquarium tanks with fresh sea water. Frequent change of water and constant aeration were tried to eliminate Ciliate attack. Attempts to rear the larvae beyond Veliger stage did not succeed. In the natural bed the spatfall started by August. This year the settlement was very poor and it was interesting to note that Modiolus sp spat have settled throughout the natural bed from June.

Mussel fishery around Vizhinjam area was very poor this year with an estimated total of 39.7 tonnes. From January to March and September to December there was mussel fishing around this area. During September fishermen started exploiting mussels ranging 35-39 mm. Poor settlement and depletion of the stock by indiscriminate exploitation has resulted in much lower production this year. Maximum fishing effort and catch were recorded during December.

Madras

During the year the work on the culture of green mussels in the open sea was continued at Kovalam. Adult mussels were collected from Annore and suspended from the rafts to form the spawning stock. Spat fall of mussels on a small scale was observed on the tiles suspended from the raft by the end of March 1977 and the spats measured about 5 mm in length. Heavy spawning of mussels was observed by the end of April 1977 and numerous spats measuring 5 mm in length were observed on the tiles by the middle of May 1977. Abundant seeds measuring 15-20 mm in length were available for seeding during June 1977. Coir ropes were used for seeding as better attachment by young mussels was noticed on them than on nylon ropes. During July 1977 thirty five ropes were seeded with mussel spats weighing 4½ - 6 kg. per rope.

The growth of the mussels in the farm area was quite good and an average growth rate of 12 mm per month was noticed. By the end of September 1977, the sea became rough and in view of the North-east monsoon in October the rafts were dismantled. Two or three fold increase in weight of the seeded mussels was noticed in about 70-74 days. The total weight of seeds used in the experiment was 165 kg. and they had grown to a weight of 320 kg. The length of the spat at the time of seeding varied from 15-20 mm and at the end of the season after 45 days varied from 40-45 mm.

Experiments to continue the mussel culture during North-east monsoon months were unsuccessful due to severe cyclone during October 1977.

The rocks at Kovalam have been successfully colonised by the green mussels affording an abundant supply of seeds for seeding the ropes during 1978.

Mariculture - Culture of Molluscs clams and Cockles(MOL/CUL/1.3)

K.A. Narasimham, Y. Appanna Sastry and P.V. Sreenivasan.

Kakinada

Work on Anadara granosa was continued based on fortnightly collections made from the Kakinada Bay. The size range of the cockles in commercial catches varied from 15-71 mm and modal length ranged from 25-59 mm. The monthly distribution was usually unimodal; the 29-39 mm modal lengths dominating the catches. The average condition index based total weight of the cockle varied from 14.5 - 20.6. This condition index was generally high in April and August to first fortnight of November. The condition index based on shell weight varied from 20-9 - 32.0 and followed the same pattern as the condition index based on weight. There was considerable variation of condition index between the individuals collected on the same date. The percentage of solids in wet meat weight varied from 16.5 to 25.2 and generally high during April - September. Examination of gonad smears showed the cockles in spawning condition throughout the study period (April-December). The temperature of the waters over the cockle bed varied from 24.5°C to 32.0°C, salinity from 0.52 to 31.92‰ and the dissolved oxygen from 2.66 to 10.23 ml/l. Three days after the cyclone (23-11-77) the salinity touched a low 0.52‰ due to heavy fresh water influx.

Work was initiated on the biology of Meretrix spp. from a mall bed near Kakinada Bay. During April Meretrix spp. measured 44-81 mm and in April 44-75 mm. From June onwards, samples were not available as the clams became scarce. The gonadial conditions revealed that clams were partly spawned and spent condition during April and May. Intensive search continued for the collection of the above species and only Umbonium spp; Cerethium spp; Anadara granosa; Pholas spp; Oliva gibbosa; Turritella spp:

Placenta; placenta; Pecten crassistatus; and Paphia spp etc were encountered in small numbers.

Porto Novo

Culture experiments on the backwater clams Meretrix casta and Katelysia opima were continued. Experiments on M. casta for the last one year proved that this species can be cultured in new places where there were no clams earlier by providing suitable substratum. Based on the results obtained, an intertidal pond was excavated in the Vellar estuary and this species along with a limited numbers of K.opima were introduced during the month of September 1977.

FISHERY ENVIRONMENTAL DIVISION

OCEANOGRAPHY

Environmental studies - Physical and Chemical aspects (MBO/ES/1.1)

A.V.S. Murty, C.P. Ramamirtham, D. Sadananda Rao, N.S. Radhakrishnan, G.G. Annigeri, R. Marichamy, V.S.K. Chennubhotla, S. Muthusamy, P. Mojumder and others.

Salient findings:

Detailed hydrographic investigation of the south eastern Arabian Sea within the latitudes of 8° E during winter revealed many interesting features of distribution of temperature, salinity, and dissolved oxygen of the waters. The thermal field revealed that the stratification of the thermocline was much stronger in the westernmost part off Cochin, off Calicut, off Mangalore and off Karwar. The mostly isothermal mixed layer was again more clearly evident in the western regions. But in the section off Cape Comorin the thermocline was weaker. In the zonal section along the 14°N parallel, the thermocline was observed to start at about 40 m in the offshore region, whereas in the near coastal area the same was observed at about 80 m. depth. Thus a gradual sinking of isotherms could be inferred towards east.

A salinity maximum with a core value of 36.5‰ was observed in the offshore regions, with a well developed tongue of high salinity which was observed to sink towards east. Over the continental shelf and the slope, the salinity values were much lower and within a distance of 15-25 km from the coast, the salinity values were as low as 31.6‰. Below a depth of about 150 m, the distribution of salinity values ranged from 34.8‰ to 35.2‰.

The distribution of dissolved oxygen in the mixed layer did not reveal any marked spacial difference, the values ranging between 4.5 ml/l and 5 ml/l. The oxygen deficit layer was evident in almost all the sections from 100 m to 1000 m depth,

values being invariably between 0.3 ml/l and 1.0 ml/l. The vertical extent of the oxygen deficit layer was lesser in the northern region than in the southern one.

The regional characteristics of sea water were also studied at different centres along the coast of India and the salient findings are as follows:

Bombay

The temperatures of air and sea surface water showed double maximum the peaks occurring during May and October. Salinity ranged from 30.6‰ (June) to 36.0‰ (October). Dissolved oxygen values were between 4 ml/l and 5 ml/l except during June when it was only 3.4 ml/l.

Mangalore

Gradual increase in surface temperature was observed during January-March period. The maximum temperature of 32.0°C was recorded in the first week of April; thereafter temperature started declining. The lowest temperature of 23.5°C was observed in the fourth week of September and a rising trend was noticed in October-November period followed by a slight decline in December. The maximum salinity value of 36.04‰ was recorded in the last week of April and the lowest value of 3.59‰ was in the first week of August. The minimum and maximum salinity values recorded during the previous year were 17.77 and 34.61‰ respectively. The oxygen values were generally higher in January-February period and also in August. The range of oxygen values was from 3.42 to 5.70 ml/l. The inorganic phosphate values were higher in January-April and August-October period. The minimum and maximum phosphate values recorded were 0.09 and 1.07 ug at/l respectively.

Karwar

The annual variationsof temperature, salinity and dissolved oxygen off the waters off Karwar are presented in the figure.

The temperature showed double maximum, with peak values in April and October/November. Due to monsoon rains, the surface water salinity dropped drastically during July/August (less than 8‰) while the bottom water salinity was above 30‰. Dissolved oxygen of the surface waters was between 4 ml/l and 5 ml/l during most of the months and the value was never less than 3.5 ml/l. The bottom waters were depleted from oxygen (less than 1 ml/l) during July is to September (Southwest monsoon) period. The inorganic phosphate in the surface waters was generally 0.15 ug at/l while its value in the bottom waters was 0.25 ug at/l. The PH value of the surface waters was 7.8 during July and August but it was never less than 8 during rest of the months of the year.

Madras

During most of the months of the year, the salinity value of the waters off Madras ranged from 32‰ to 34‰. However, the salinity values were lower (between 25‰ to 26‰ at the surface and between 26‰ to 30‰ at the bottom) during the period of October to December. Dissolved oxygen in the waters (including bottom waters) was never less than 4 ml/l.

Progress of work

The southeastern Arabian sea was studied in its water characteristics. Oceanographic conditions were monitored from various places like Bombay, Karwar, Mangalore, Calicut, Mandapam Camp, Tuticorin, Madras and Waltair.

Work contemplated

Monitoring would be continued for oceanographic parameters such as temperature, salinity, dissolved oxygen, hydrogen ion concentration and nutrients from various research centres along the west coast as well as east coast of India. Regular observations could be carried out and various charts would be prepared to analyse the data.

Investigations on the ecological conditions of the Vembanad Lake (MBO/ES/1.2)

A.V.S. Murty, V. Kunjukrishna Pillai, R. Vasanthakumar, A. Regunathan.

Salient findings

During the year under report, the Thannermukkom bund remained closed for five months (January to May) and the area south of the bund remained practically cut-off from the rest of the lake system during this period. Hydrological parameters recorded did not show any significant changes in the environment.

It was observed that there is a newly formed clam bed (Villoritta sp.) located a little north of Vaikom. About fifty country boats were engaged in fishing for the clams. On an average each boat fished about 150 to 200 kg. each day. This is the first time such a clam bed is observed in this area. It is quite possible that the formation of this clam bed might have resulted due to the change in the circulation pattern of the lake due to the closure of the bund.

Progress of work

Regular sampling programme from six selected stations in between Pathiramanal and Cochin were carried out. Samples were collected for hydrography, primary production, zooplankton and the fishery resources.

Work contemplated

The changes would be studied in the faunal, floral, ecological and biological environments as well as fisheries of the Vembanad Lake consequent on the construction of the Thanneermukkom Bund with a view to suggest conservational measures for the living resources of the lake.

Circulation and related phenomenon - Circulation pattern in the region south of Cochin along the south west coast of India (MBO/ES/2.1)

C.P. Ramamirtham, D.S. Rao and others.

Salient findings

During pre-monsoon period lateral movements were negligible in the mixed layer. In the Quilon bank area weak southward drifts could be inferred at the top of the thermocline around 75 metre depths. The weak southward drifts observed during April get intensified during May and off Quilon these movements appear to have deformed into a cyclonic gyre in the Quilon bank area. Such divergence zones can be preliminarily considered as a prelude to the large scale divergence phenomenon occurring in the Arabian Sea during active monsoon period.

Progress of work

The final processing of the data for this region is being continued.

Work contemplated

A paper dealing with the above aspect is under preparation.

Circulation and related Phenomenon - Circulation pattern in the region north of Cochin along the Southwest coast of India (MBO/ES/2.2)

D.S. Rao, C.P. Ramamirtham, R. Vasanthakumar, P.M. Aboobaker, K.P. Viswanathan.

Salient findings

Sinking of offshore waters at the top of the thermocline over the shelf was observed in the sections off Calicut, off Mangalore, off Karwar, along 14°N and 16°N latitudes, during the month of December. The intensity of the sinking phenomenon was noticed to increase in the northern sections. In the section off Karwar an anticyclonic eddy of nearly 100 miles width was observed at the top of the thermocline revealing the presence of the convergence phenomenon in the region during the winter. A weak northward flow was also observed within the thermocline during the winter period along the coast in the northern regions.

Progress of work

The vertical distribution charts of various parameters such as temperature, salinity and dissolved oxygen have been prepared in all the sections and interpretation of the charts have been done in terms of circulation.

Work contemplated:

A detailed paper on the above study is under preparation for publication. The circulation patterns in this region during other seasons will be studied in detail.

Preparation of Fishery Oceanographic Atlas (MBO/ES/3)

A.V.S. Murty, C.P. Ramamirtham, D.S. Rao.

Progress of work

Charts pertaining to temperature, salinity and dissolved oxygen distribution patterns in the vertical and along the zonal sections off the west coast of India were prepared.

Work contemplated

The distribution patterns in the lateral planes of the essential oceanographic properties would be drawn.

Mub banks of the Kerala coast and their influence on fisheries (MBO/MB/1.1)

A.V.S. Murty, D.S. Rao, K.J. Mathew, C.P. Gopinathan, A. Regunathan, V.K. Balachandran and C. Thankappan Pillai.

Salient findings

The observations conducted so far indicated that the formation of the mud banks during 1977 was not so good as in previous years. Complete calmness of the areas were located only in rare cases.

Progress of work

During the year, observations were continued at Various mud bank regions especially at Ambalapuzha-Purakkad-Thottappilli region and the region between Vypeen Munambam.

Work contemplated

Particle size analysis and mineral analysis of the mud samples would be carried out. The bulletin on the mud banks would be completed.

Ecological Energetics (MBO/ES/1.2)

C.P. Ramamirtham and others.

Salient findings

During late sinking season in the region off Cochin in January the surface and bottom salinity values in the near shore regions were low between 32 and 32.5‰. Gradual increase in temperature was noticed by progress of season and in March the range was from 30 to 32°C. Dissolved oxygen contents upto 20 metre depth was between 4 and 4.5 ml/l.

During monsoon the surface salinity value decreased to about 12‰ due to rain and fresh water influx and the oxygen contents at 10 & 20 metre depths were much lower than summer, values as low as 2.5 ml/l being observed.

The C14 technique indicated that the rate of production at surface and bottom during the first quarter were moderate and a slight increase was observed in the second quarter and throughout the year the benthic productivity rates were very low.

Progress of work

The periodical investigation of the hydrographic features in the Cochin region is being continued.

Work contemplated

More detailed investigations in the region with reduced time lags, especially during the monsoon season are to be carried out.

MARINE BIOLOGY

(MBO/PP/1.1 Investigations on phytoplankton and primary productivity of the shelf and adjacent waters.

P.V.Ramachandran Nair, M.M.Jose, R.S.Pande, Racheel Cheriyan, Aravinda Hebbar, G. Regothaman, C.P.Gopinathan, V.K.Balachandran, K.G.Girija-vallabhan, C.V.Mathew.

Salient findings

For the first time regular observations have been made on productivity and related parameters off Visakhapatnam in the enclosed area of the outer harbour and in the open sea. The mean rate of production varied between 3 and 39 $mgC/m^3/hr$ in the backwaters; 2 and 18 $mgC/m^3/hr$ in the open sea outside the harbour; and between 0.5 and 17 $mgC/m^3/hr$ in the enclosed area of the harbour. Low oxygen values are observed in April at all the stations with a sharp increase of oxygen towards May. The phosphate content is relatively higher at the outer harbour area. These would serve as baseline data for evaluating the ecological changes that would be brought about with the commencement of production in the proposed steel complex.

Work in progress

At Cochin: During the year 7 cruises on board 'Cadalmin' were undertaken to measure the rate of productivity in the fishing grounds of Cochin. In addition diurnal variations of production and other relevant parameters were measured for a continuous period of 36 hours to evaluate the magnitude of variation resulting from changes in sampling time. The results indicate a definite diurnal rhythm with the maximum during the preceding hours before noon. Data have not been processed due to the defect in counting system which has since been rectified.

At Visakhapatnam: Work was started in April 1977 at the outer harbour area, open sea and in the backwaters of Bhimilipatinam and Nagamayapalam. Rate of organic production, as measured by oxygen technique, has not been following any regular pattern either at the mouth of Bhimili backwaters or at the outer harbour area. The mean rate of production varied between 39 and 3 mgC/m^3/hour at the mouth of Bhimili backwaters, between 18 and 2 mgC/m^3/hr at the outer harbour area and the open sea and between 17 and 0.5 mgC/m^3/hr at the enclosed area. In May higher rates of production were observed at all the three regions.

At Madras and Calicut though a few observations have been taken data could not be processed due to the failure of the counting system.

Work contemplated:

Intensification of observations at all centres and a detailed study of the perennial and seasonal prawn fields in the adjacent areas of the Cochin backwater system for evaluating the potential for stocking of prawn seeds.

Culture of economically important seaweeds (MBO/SW/1.2)

V.S.K.Chennubhotla, S. Kalimuthu, P. Radhakrishnan, G. Ragothaman.

Work done

During the period under review culture of economically important agarophytes and alginophytes was carried out in Palk Bay (fish farm area), Gulf of Mannar (CMFRI jetty and Hare island), and in Vizhinjam Bay.

Gracilaria edulis introduced in Palk Bay waters showed good growth but heavy grazing by some of the fishes like Tetradon, Siganus, Psammoperca etc. has hampered further growth. Fencing of the culture site with a nylon net of 1" mesh size was of no avail.

In Gulf of Mannar seventeen coir rope nets of the size 2 x 5 m each with G. edulis as seed material introduced near C.M.F.R.I. jetty has shown good growth. Eight coir nets introduced with G.edulis as seed material in Hare Island had a very luxuriant growth.

In Vizhinjam, field and laboratory culture experiments on Gracilaria corticata were carried out.

Laboratory culture experiments on germination of carpospores of G.edulis were continued. Experiments with G.edulis fragments in enriched seawater medium were carried out. Plasticraft Pools with coral stones and running seawater were set up with carposporic plants spread over the stones to enable the spores to settle on the substratum soon after liberation.

An assessment of Sargassum resources exploited from Mandapam area for industrial purposes, and its effect on the stock was made.

Work contemplated

Demonstration project at Hare Island; Survey of Seaweed resources along the Kerala coast and Andaman islands.

Secondary production of the shelf and adjacent waters (MBO/PL/1.1)

K.J.Mathew, K.Rengarajan, C.V.Mathew, K.G.Girijavallabhan, S.Muthusamy, S.Krishna Pillai, R. Marichamy, Pon.Siraimeetan, C.M.Allikunju.

Salient findings:

Four species of siphonophores, namely Frillagalma vityazi, Marrus orthocannoides, Amphicaryon peltifera and A.ernesti were recorded for the first time from the Indian waters. The presence of four meso- and bathypelagic species in the epipelagic zone of the south west coast of India has been attributed to the process of upwelling in this region. At Bombay, 31 juveniles of mackerel ranging in size between

73-87 mm (T.L.) have been caught from the area 17-72/2A during November. At Madras, the biomass of zooplankton showed wide fluctuations from 1.5 ml in September to 35 ml in January per 15 minutes haul. At Tuticorin the range of fluctuation was between 5.0 and 28.7 ml per 10 minutes haul. However, at Mangalore it was noticed that, in general, the zooplankton biomass evinced high values in 1977 when compared with the previous year. At Calicut, the biomass was comparatively richer at the 25 m. zone than at the 15 m. zone.

Work done:

COCHIN: Studies on the siphonophores of the west coast of India and the Lakshadweep Sea were continued. Based on the distribution pattern the species are broadly classified into neritic forms, oceanic forms and those common to both the realms. Four species have been recorded for the first time from the Indian waters. The presence of some meso- and bathypelagic species of siphonophores in the epipelagic zone has been considered as due to the process of upwelling along the south-west coast of India.

BOMBAY: At Bombay, the zooplankton biomass ranged between 1.1 ml in August and 14.2 ml. in October, per ten minutes haul. Copepods were the dominant groups in all the months; their peak occurrence were recorded in April and November. Salps were abundant from October to December while the chaetognaths were characteristic during November and December. 31 juveniles of Rastrelliger kanagurta were caught in the trawl net from the area 17-72/2A in November. In December, 20 adult specimens were also caught from the area 18-72/2A.

MANGALORE: Regular plankton samples were collected from the 1.5 and 2.5 m. stations off Mangalore Coast. Fluctuations in the plankton biomass showed a range between 1.00 and 23.83 ml at the shallower station while it was between 12.00 and 20.75 ml at the deeper station.

CALICUT: Regular investigations on the zooplankton biomass, species composition and hydrography were carried out off the coast of Calicut at 15 m and 25 m stations. Biomass of zooplankton was comparatively richer at the 25 m station than at the 15 m station. Copepods were the dominant groups followed by medusae, chaetognaths, decapod larvae, amphipods, salps etc.

TUTICORIN: Plankton sampling was done at the fishing grounds off Tuticorin between the depth range 4 and 28 m. Zooplankton biomass varied from 5.0 to 28.7 ml per 10 minutes surface haul, the highest values being obtained during November and December. The percentage contribution of fish eggs and larvae were high during January-February and August-October.

MADRAS: Standing crop of zooplankton showed wide fluctuations, the variations being at the range 1.5 ml (September) and 35.0 ml (January) per 15 minutes haul. Copepods were abundant in August, and from October to December. Maximum number of carnivorous forms, namely decapod larvae and chaetognaths occurred during January. Fish eggs occurred in large numbers during all the months with a peak in October. Fish larvae were poorly represented in the samples.

Work contemplated:

Apart from the routine planktonological observations which are being carried out at different centres, more emphasis will be given to study the relationship between the secondary production and the regional fisheries.

Ecological energetics in cultivable marine organisms. (MBO/EE/1.1)

P.V. Ramachandran Nair, D.C.V. Easterson, C.V.Mathew and M.Vijayakumaran.

Salient findings:

The conversion efficiency and the nitrogen budget for M.dobsoni using artificial feed was found to be 39.62% (gross)

and 49.3% (Net#) and nitrogen budget was found to be for growth 38.7%, moult 0.60% and for metabolism 40.79% making up a total of 80.8% assimilate and the rest faeces.

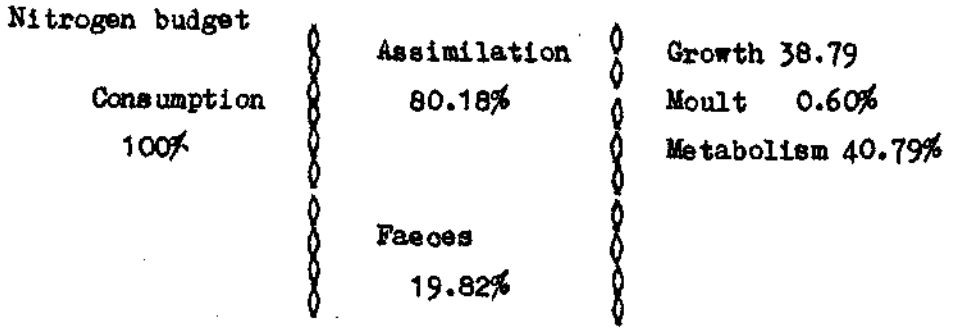
Feeding response of Crassostrea madrasensis cultured at Tuticorin to live phytoplankters was investigated using Tetraselmis, Oscillatoria and Amphora. The response was found to be negative.

Work done:

The conversion efficiency and nitrogen budget of Metapenaeus dobsoni using artificial feed were finally determined and are as follows:

Gross conversion efficiency (K1) - 39.62%

Net conversion efficiency (K2) - 49.34%



The investigation on the edible oyster, Crassostrea madrasensis is being continued. The problem of proper algaeas food and the maintenance of the oyster for a prolonged duration under laboratory conditions is being studied. The response in feeding with cultures of Tetraselmis and a few other algae was also being studied, in order to locate suitable species for feeding the oysters in the laboratory.

At Calicut feeding experiments were conducted with mussels. But no significant results were obtained.

Marine Pollution in relation to the protection of living resources (MBO/MP/1.1)

P.V.Ramachandran Nair, V.Chandrika, M.V.Pai, G.G.Annigeri, V.S.K.Chennubhotla, M.S.Rajagopalan, M.Kunjukrishna Pillai, C.P.Gopinathan and C. Thankappan Pillai.

Salient findings:

Water pollution monitoring was carried out at Cochin, Calicut, Karwar and Tuticorin. At Cochin bacteriological studies by the use of faecal index reveal that in the estuarine areas the pollution from human waste is more compared to animal sources. At Karwar no further fish mortality was reported. At Tuticorin an inventory was prepared on the various industrial establishments and the nature and concentration of pollutants in their effluents, in order to carry on an effective monitoring programme.

Work done:

At Cochin: Regular monitoring of bacterial pollution in the Cochin backwater was carried out. It was observed that microbial flora of the Cochin backwater is dominated by organisms of pollutional, fresh water and soil origin. Seasonal sampling showed that the dominating interesting groups here are actually the fermentative, polar flagellated (Aeromonas vibrio) ones which may be of pollutional origin. Also, the abundance of indicator bacteria was noted in places near the sewage effluents. Distal areas near the sea remain more or less free from pollution of this organisms owing to the dilution of open sea water especially during high tide. Source and nature of pollution was determined by constructing faecal index.

Laboratory experiments were conducted on selected marine animals to determine the LC_{50} values for pesticides such as hexadrin and endrin. Response in the photosynthetic behaviour of selected phytoplankters and natural populations was measured by C^{14} uptake in presence of the above pesticides.

At Calicut: Observations were taken up on the extent of water pollution from the inshore areas of Beypore Bay upto the Mavoor industrial area where extensive mass fish mortality was reported during March/April 1977. A monitoring programme on the BOD and other relevant parameters is being continued.

At Karwar: In the Binage Bay, where earlier mass fish mortality was reported when residual chlorine from the effluents of M/s.Ballarpur Industries exceeded 1 ppm, monitoring was continued. The residual chlorine was always less than 1 ppm level.

At Tuticorin: An inventory was prepared on the various industrial establishments and their marketing products, nature and concentration of pollutant, locations where the pollutants are discharged, and pre-treatment arrangements for evaluating the impact of the pollutants and for planning of remedial measures to be taken.

Work contemplated:

Intensification of monitoring programmes at various centres to collect more data on various parameters such as BOD, specific pollutants etc.

Benthos of the fishing grounds off Cochin. (MBO/BF/1.1)

V.Kunjukrishna Pillai, C.P.Gopinathan,
A. Regunathan.

Salient findings:

The data collected so far indicate that the benthic region in the depth range of 10 to 20 m. was observed to be comparatively abundant as far as the benthic fauna are concerned. From the overall picture obtained by the observations, the fishing ground at 20 m. depth appeared to be more productive when compared to other areas investigated in the inshore region.

Progress of work:

Under this programme, regular collections were taken from the fishing grounds off Cochin. Samples were collected and analysed from 10, 20, 30 and 40 m. depths for hydrography, primary production, zooplankton and benthos.

Stations.	I	II	III	IV	V	VI
Temp.°C	29.50	29.25	30.00	29.80	30.25	28.70
Salinity ‰	28.93	30.15	32.59	30.23	30.79	32.67
D.oxygen ml/L	4.18	4.06	3.62	3.56	3.86	3.45
pH	7.23	8.71	8.62	8.40	8.00	8.10

In the first quarter the rate of primary production at the surface and bottom was moderate (5 to 10 mg $C/m^3/hr.$) But the benthic production estimated on mud samples indicated very low production rate (0.1 to 0.4 mg $C/m^3/hr$). The values for the second half revealed slight increase especially at the surface. The rate of benthic productivity did not show any significant variations in the remaining period.

The data collected indicate that the area from 10 to 20 m. appears to be more productive in the inshore region as far as the benthic fauna are concerned. Molluscs dominated the faunal representation both in quantity as well as quality. However, echinoderms were abundant at 20 m. during the month of May. The fish catch obtained by trawling indicated an abundance around 20 m.

Work contemplated:

The project is reoriented to give more emphasis on the effect of weed deposits in the fishing grounds and their possible effects on the fishery resources of this region.

Investigations on the coral reef resources (MBO/Cr/1.1)

C.S. Gopinatha Pillai

Salient findings:

The fringing reefs of Karachalli and Hare Islands in Tuticorin was surveyed at low tide. The distribution, abundance and coral faunal assemblage were studied. The major reef associate animals on these reefs were also qualitatively studied.

The fringing reefs of Tuticorin were compared with those of Rameswaram Island.

The formation and species diversity of the south Indian reefs were explained. They are formed on the edges of parts of mainland cut away due to a wide subsidence in recent time.

Part of the work on the coral fauna of the Indian Ocean was carried out. Four hundred and forty species of corals were found to occur in the Indian Ocean including the Red Sea.

Works contemplated:

The work on the coral fauna of the Indian Ocean will be completed. The taxonomic history, affinities, distribution and their characters will be discussed for each species.

Studies on the fringing reefs of Gulf of Kutch will be undertaken with special reference to their ecology and resources.

Investigation on useful and harmful sponges

Project Code No. MBO/SP/1.1

P.A. Thomas, K. Ramadoss.

Salient findings

Finalized a report on the Dermospongiae of the Minicoy Island. This account deals with 41 species referrable to 32 genera and 23 families. Also, 20 species of sponges from Papua New Guinea Area were identified.

Detailed investigations were conducted on the boring sponges which pose a threat to the rock oyster fishery in the estuarine areas of Goa. In the light of studies conducted so far, it is concluded that Cliona vastifica is the only adapted species to the estuarine conditions and it can even pose a serious threat to the rich oyster populations in the estuary.

Progress of work:

Investigations were conducted on the sponges of the Goa Coast. Of a total of 13 species identified so far, 4 species belong to the boring forms. Of the four boring forms, one species i.e., Cliona vastifica Hancock by virtue of its tolerance to low salinity has gained considerable access to the estuarine regions and its main target is the shells of gregarious molluscs such as Crassostrea cucullata found in abundance in these regions.

Regarding the incidence of boring sponges in the estuaries of Goa, it is estimated that about 6-9% of the Crassostrea population were infested with C.vastifica. But in the case of window pane oysters the percentage of incidence noted is as high as 62.9%. Racial studies pertaining to C.vastifica is in progress. Technical helps were rendered to many Indian scientists as well as to many foreign Institutions.

Works contemplated:

More emphasis will be given to study the economic importance of the incidence of sponges on the window pane oysters. Also,

the sponges associated with molluscs cultured in different centres will be studied in detail.

The eggs and larvae of commercially important fishes from the shelf and adjacent waters. (MBC/FEL/1.1)

C.Mukundan, K.Rengarajan, I.David Raj, G.S.D.Selvaraj, S.Krishna Pillai, K.G.Girijavallabhan, M.Rajagopalan and Pon.Siraimeetan.

Salient findings:

Fish eggs and larvae were collected from the fishing grounds off Bombay, Cochin, Tuticorin and Madras. At Bombay, fish eggs were abundant in November while fish larvae were recorded in high numbers in April and December. At Cochin backwaters, Anchoviella eggs and Ambassis eggs were found to be abundant. Availability of fish eggs and larvae was high in the waters of Pinnakayal trench (Tuticorin), Spic Coast and in the area 8-78 during January - February and July-October. At Madras, fish eggs and larvae were found to be abundant during October. Anchoviella eggs were the commonest at Madras during October.

Progress of work:

Bombay: Fish eggs and larvae from the fishing grounds off Bombay were studied and the pattern of availability showed that fish eggs were more abundant in November and fish larvae in April and December.

Cochin: Observations on the fish eggs and larvae of the Cochin backwater plankton showed that Anchoviella eggs and Ambassis eggs were abundant in the area.

Tuticorin:

Samples for the study were collected from the fishing grounds of Pinnakayal trench, Spic coast and the area 8-78. The availability of fish eggs and larvae were greater in January-February and in July - October; their part in the sample composition went up to nearly 29%.

Madras: Plankton collections made on board the EFP vessels operating off Madras were analysed for the study. Fish eggs were found to be most abundant in October. Anchoviella eggs were the commonest.

Works contemplated:

Estimation of total fish eggs and larvae in plankton samples and their relative abundance in space and time will be continued. Further emphasis will be given to study the spawning grounds and spawning periods of important species.

Ecological studies of mangrove swamps (MBO/MS/1.1)

M.S. Rajagopalan, C.S. Gopinadha Pillai, C.P. Gopinathan, G.S. Daniel Selvaraj, P.M. Aboobaker, A. Bastian Fernando and A. Kanagam.

Ecological studies of the mangrove swamps around Cochin and Tuticorin were continued during the year. Routine data on the water temperature, salinity, oxygen content, primary productivity etc. were collected during the months when boat facilities were available.

At Cochin, the survey was extended to a group of small reclaimed islands in the harbour area where typical mangrove conditions prevail. The vegetation is not much different from those in the other stations around Perumbalam in the Cochin backwaters.

The resident fauna of the reclaimed islands is characterised by the presence of Cerethidium in large numbers in the lower muddy regions; different species of hermit crabs and other crabs in the higher levels and the presence of juveniles of Therapon, Haplocheilus, Etroplus and prawns in the creeks and ponds. The salinity and temperature in the ponds and creeks are subjected to wide fluctuations due to tidal influence.

A marked decrease in the salinity was noticed in the stations around Perumbalam during the monsoon months. But the usual compliment of juveniles of fishes and prawns were available in

good numbers. In the small ponds at station 4 of Perumbalam Etroplus could grow to good size and breed also.

At Tuticorin; No marked change was noticed in the vegetation, the predominant species being Avicenia bordering the hedges of Salicornia.

The population density of Cerethidium varied from 300-470/Sq. metre and that of crabs from 10-12/sq. metre. Among fish seeds, mullets and Haplocheilus were abundant but Sillago sihama was totally absent. Chanos fry were also less abundant. There are indications that the prawn juveniles were declining in numbers over the past few years. The causes for these fluctuations are being investigated.

INTER - DIVISIONAL PROJECTS

Survey of Mollusc (bivalves), prawn and fish seed resources
CMFRI/IDP/1.

E.G. Silas, K. Rangarajan, M. Rajagopalan, K.S. Sundaram, K.M. Ameer Hamsa, P. Namalwar, R. Thiagarajan, C. Nandakumar, S. Shanmugham, Bastin Fernando, K. Prabhakaran Nair, S. Lazarus, K.J. Mathew, G.S.D. Selvaraj, K.N. Gopalakrishnan Nair, N. Gopinatha Menon, P. Ramadoss and K. Nandakumaran.

COCHIN:

The data collected during 1976 have been analysed and the highlights of the findings are given below.

Of all the seeds the prawn seeds were the most abundant in the surf area. These showed a region-wise and season-wise variation (fig.). The seeds of three species of prawns namely Penaeus indicus, Metapenaeus dobsoni and M. monoceros were obtained. The maximum abundance of prawn seeds was noticed during the May-August period.

The fish seeds were represented mostly by the larvae of Ambassis, mullets, therapponids, Chanos and some clupeids. The south west monsoon months were the lean period for the fish eggs and larvae.

The mussel spats of the genus Perna were found to settle on to the groynes by July. The spat settlement used to be very heavy that there is hardly any space available for the growth of the animals to any appreciable size. By the end of the winter most of them perish due to deposition of sand over them.

Edible oysters were found to occur in small quantities at the mouths of rivers and estuaries and also some distance inside.

During 1977 six cycles of seed surveys were undertaken and 195 stations have been covered for the collection of various samples.

VIZHINJAM

Regular surveys were conducted from Neendakara to Manakkudi Lake. Mullet fry were found to be the most abundant resources at almost all centres. Bulk of the fry was below 20 mm size. It has been observed that at those centres where the mullet fry were rich in 1976, they were scarce during 1977. It was observed that very shallow and flat bottoms with medium and fine sand offered suitable grounds for the mullet fry.

Some juveniles of Chanos were collected from the marshy areas at Adimalathura during first half of the year.

Post larvae and juveniles of P.indicus and M.dobsoni were quite abundant in Manakkudi Lake and Paravoor Lake respectively. Clam beds were noticed at Thengapattinam and Veli Lake.

MANDAPAM

Eighty five field trips have been conducted during the year. The fingerlings of mullets were present throughout the year at all the places visited. Chanos fry showed two periods of occurrence in the Pamban waters; one during April to July and the other from October to December. The Mugil fingerlings have been estimated to be 4,62,000 per hectare in June and Chanos at the rate of 15,730 per hectare in April. Larvae of P.indicus were present at the rate 15,730 per hectare at Muthupet and 3,00,000 per hectare in Palk Bay in August.

The edible oyster occur close to the mouth of Athankarai estuary and the backwaters of Kanchiragudi. Clams of the species Meritrix casta are thickly populated in some of the areas in Athankarai estuary. Observations on various species of sea weeds were also conducted.

Fish and shell fish diseases (CMFRI/IDP/2)

S. Mahadevan, G.S.D. Selvaraj, M. Kathirvel, C. Thankappan Pillai and others.

During the period, the aetiological agents for the diseases 'Pseudomonasis' and 'Vibriosis' were identified as Pseudomonas fluorescans and Vibrio anguillarum respectively. The detailed characteristics of the organisms were also studied.

In addition to this, bacteriological survey has also been carried out at Vizhinjam in mussels in the raft culture as well as from the natural beds. The water samples were also examined. The investigation proved that the mussels in the raft culture were comparatively more polluted with enteric bacterial forms than that in the mussels from the natural beds. The water samples were also found containing these bacteria.

National Programme of tagging oil sardine, mackerel and prawns (CMFRI/IDP/3)

P. Vijayaraghavan, A. Noble, M.M. Thomas P. Sam Bennet and others

Salient findings

A total of 4268 oil sardines, 312 mackerel and 4128 prawns belonging to species Penaeus indicus, Metapenaeus dobsoni, M.affinis and Parapenaeopsis stylifera were tagged and released in the sea off Cochin during this year. In the back waters 7794 prawns of species P.indicus, P.semisulcatus, P.monodon, Metapenaeus dobsoni, M.affinis, M.monoceros and Parapenaeopsis stylifera were tagged.

At Cochin

Tagging operations at sea:

In the first quarter 8 trips were undertaken during which 3218 prawns were marked and released at 15-20 meter depths off Cochin. During these trips 8 sardines and 2 mackerel which came in the trawl catches were also marked and let off.

Recoveries were limited to 40 prawns. Most of these were recovered within ten days of release while 7 prawns were recaptured between 2 - 5 weeks after their release. All the recoveries were from the same area of release except one prawn which was caught 20 km north after the lapse of one week.

The sea trips which had to be suspended during the 2nd quarter due to non-availability of launch or due to bad weather, were resumed in the third quarter during September. 307 mackerel and 57 oil sardine were tagged and released during this quarter.

In the last quarter 4203 oil sardine and 910 prawns were tagged and released.

Tagging operations in back waters:

44 tagging trips were undertaken during which 5135, 768, 1620 and 171 juvenile prawns were tagged during the first, second, third and fourth quarters respectively. The prawns belonged to the species P.indicus, P.semisulcatus, P.monodon, M.dobsoni, M.affinis, M.monoceros and P.stylifera. Of these, 2092 were marked and released in an experimental pond in the back water were to make direct growth studies, and rest were released in the open lake. The recoveries of the latter were within the first week of release and were within 3 km from the place of release.

A preliminary examination of results obtained from periodic examination of marked prawns in the experimental pond indicated the following growth rates in the species given below:-

P.indicus 0.8 mm to 1.6 mm per day in the 45 - 58 mm size group.
P.stylifera: an average of .53 mm per day in the 51-55 mm size group.
M.dobsoni: .2 mm to .7 mm per day in the 45 - 58 mm size group.

At Tuticorin: The tagging programme of sardines which was initiated in November, 1976 at Tuticorin was wound up in August 1977.

During the period of study, oil sardine from shore seine were tagged and released off Tuticorin. There has been no recovery. Tagged and untagged oil sardines kept in cages suspended in sea were examined periodically. It was observed that the species could live in cage for atleast 8 months. There was a high rate of shedding of taggs from the impounded fish.

STAFF NEWS

Induction into Agricultural Research Service

All those scientific staff of the Institute who satisfy the minimum qualification and are holding the posts in pay-scale 425-700 and above are inducted to the cadre service. The initial constitution of the service is as follows:

Scientists in S grade

1. Shri N. Surendranatha Kurup
2. Shri N. Neelakanta Pillai
3. Shri G. P. Kumaraswamy Achari
4. Shri K. G. Girijavallabhan
5. Shri K. Y. Telang
6. Shri Kuber Vidyasagar
7. Shri G. Sudhakara Rao
8. Dr. P. A. Thomas
9. Shri D. B. James
10. Shri C. Suseelan
11. Shri K. N. Rajan
12. Shri V. Thangaraj
13. Shri R. Marichamy
14. Shri D. Sivalingam
15. Shri V. Kunjakrishna Pillai
16. Shri C. P. Gopinathan
17. Dr. P. Parameswaran Pillai
18. Shri M. Devaraj
19. Shri K. J. Mathew
20. Dr. M. K. George
21. Shri K.M.S. Ameer Hamsa
22. Shri R. Sarvesan
23. Shri P. Devadoss
24. Shri M. Sreenivasan
25. Dr. V. Sriramachandra Murty
26. Shri K. S. Sundaram
27. Shri K. Devarajan
28. Shri G. S. Daniel Selvaraj
29. Shri M. M. Meiyappan
30. Shri S. Muthusamy
31. Shri K. K. Appukuttan
32. Shri K. V. Somasekharan Nair
33. Shri Alexander Kuriyan
34. Shri T. M. Yohannan
35. Shri A. Charles Christian Victor
36. Shri A. Regunathan
37. Shri P. Livingstone
38. Shri K. K. Sukumaran
39. Shri D.C.V. Easterson
40. Shri R. Thiagarajan
41. Shri S. Shanmugham
42. Shri P. Natarajan
43. Shri P. Nammalwar
44. Shri K. Prabhakaran Nair
45. Shri P. V. Sreenivasan
46. Shri S. Lazarus
47. Shri A. A. Jayaprakash
48. Shri Mohammad Zafarkhan
49. Shri M. Kuthirvel
50. Shri K. Rengarajan
51. Shri S. Krishna Pillai
52. Shri K. Narayana Kurup
53. Shri G. Nandakumar
54. Shri K. Ramadoss
55. Shri V. S. Rengaswamy
56. Shri M. Rajagopalan
57. Shri K. J. Joseph
58. Shri R. Soundararajan
59. Shri Y. Appanna Sastry
60. Shri N. Kaliaperumal
61. Shri Pon-Sivaimeetan
62. Shri P. N. Radhakrishnan Nair
63. Smt. K. Vijayalakshmi
64. Smt T. S Naomi
65. Shri N. Gopinatha Menon
66. Smt. B. Prasanna Kumari
67. Dr. P. S. Kurinkose
68. Shri M. F. Rajapandian
69. Shri K. Bafan
70. Smt. V. Chandrika
71. Shri J. David Raj
72. Shri C. V. Mathew

Scientists in S—1 grade

1. Dr. S. V. Bapat
2. Shri G. Venkataraman
3. Dr. M. J. George
4. Dr. G. S. Sharma
5. Shri K. Nagappan Nayar
6. Dr. B. Krishnamoorthi
7. Dr. B. T. Antony Raja
8. Dr. M. Vasudeva Pai
9. Dr K. Algarswami
10. Dr V. Balakrishnan
11. Shri K. Venkatanarayana Rao
12. Shri V. Balan
13. Dr P. V. Ramachandran Nair
14. Dr S. Ramamurthi
15. Shri M. Mydeen Kunju
16. Dr P. Vijayaraghavan
17. Dr N. Radhakrishnan
18. Dr (Mrs) P. V. Kagwade
19. Shri M. S. Muthu
20. Dr M.D.K. Kuthalingam
21. Dr P. Vedavyasa Rao
22. Shri M. Mahadevan
23. Shri C. Mukundan
24. Shri K. N. Krishna Kartha
25. Dr K. Radhakrishna
26. Shri C. P. Ramanathan
27. Shri D. Sadananda Rao
28. Shri K. Rangarajan
29. Shri V. S. Krishnamurthy Chennabhatla
30. Shri M. H. Dholkhed
31. Shri K. C. George
32. Dr K. Venkatasubba Rao
33. Shri G. Subbaraju
34. Shri N. S. Radhakrishnan
35. Shri G. Luther
36. Shri P. Benson
37. Shri P. Sam Bennet
38. Shri V. M. Deshmukh
39. Dr K. Satyanarayana Rao
40. Shri M. S. Rajagopalan
41. Shri V. Ramamohana Rao
42. Shri A. Noble
43. K. A. Narasimham
44. Shri S. K. Dharmaraja
45. Shri J. C. Gnanamuthu
46. Shri V. N. Bande
47. Dr T. Appa Rao
48. Shri G. G. Annigeri
49. Shri S. Reuben
50. Dr M. M. Thomas
51. Shri R. S. Lal Mohan
52. Dr C. S. Gopinatha Pillai
53. Shri K. Dorairaj
54. Shri M. Kumaran

Scientists in S—2 grade

1. Dr. G. Seshappa
2. Shri K. H. Mohamed
3. Dr A. V. S. Murty
4. Shri T. Tholasilingam
5. Dr M. S. Prabhu

Scientists in S—3 grade

1. Dr C. G. Silas
2. Dr K. V. Sekharan

Direct Recruitment to the S-1 Grade Through ASRB

Shri G. Sudhakara Rao, 22-12-76

Shri Alexander Kuriyan, 18-12-76

Dr V. Sriramachandra Murty, 22-12-76

Shri P. V. Sreenivasan, 22-12-76

Shri G. Muthiah, 5-1-77

Shri A. Chellam, 22-12-76

Miss R. Padmini, 16-12-76

Shri P. V. Radhakrishnan, 23-12-76

Miss Gracy Mathew, 23-12-76

Shri G. Gopakumar, 30-12-76

Miss Mary K. Manisseri, 4-1-77

Dr E. Vivekanandan, 29-12-76

Shri M. Rajamani, 30-12-76

Shri Gorugantla Syda Rao, 5-1-77

Shri Kakati Vithal Sankarrao, 7-1-77

Shri V. Thangaraj Subramanian, 15-1-77

Shri A. Lakshminarayana, 10-1-77
Shri P. Muthiah, 12-1-77
Shri N. Ramachandran, 12-1-77
Shri Sushanta Kumar Chakraborty, 14-1-77
Shri Madan Mohan, 15-1-77
Shri Dashmukh Vinay Dattatraya, 17-1-77
Dr S. Kulasekara Pandian, 29-1-77
Shri G. Mohanraj, 29-1-77

Direct Recruitment to S-2 Grade

Dr S. V. Bapat, S-1, as S-2 at Bombay, 27-12-76
Shri G. Venkatraman, S-1, as S-2 at Mandapam Camp, 20-12-76
Shri K. Nagappan Nayar, S-1, as S-2 at Tuticorin, 22-12-76
Dr P. V. Ramachandran Nair, S-1, as S-2 at Cochin, 18-12-76
Dr P. Vedavyasa Rao, S-1, as S-2 at Cochin, 20-12-76
Dr K. Alagaraja, S-1, as S-2 at Cochin, 30-12-76

Appointments in connection with reorganisation of Technical Services

Shri P. Karunakaran Nair, Research Assistant, as Sr. Technical Assistant (T-4)

Shri K. V. George, Research Assistant, as Sr Technical Assistant (T-4)

Shri G. Balakrishnan, Research Assistant, as Sr Technical Assistant (T-4)

Shri Varughese Philipose, Research Assistant, as Technical Assistant (T II-3)

Shri T. Prabhakaran Nair, Research Assistant, as Technical Assistant (T II-3)

Shri U. K. Saiyavan, Research Assistant, as Technical Assistant

[illegible] Nair, Research Assistant, as Technical Assistant (T II-3)

Shri G. M. Kulkarni, Research Assistant, as Technical Assistant (T II-3)

Shri W. Venugopalan, Research Assistant, as Technical Assistant (T II-3)

Shri S. Srinivasarengan, Research Assistant, as Technical Assistant (T II-3)

Shri K. Ramachandran Nair, JSA, as Technical Assistant (T II-3)

Shri S. Kandasami, JSA, as Technical Assistant (T II-3)

Shri A. C. Sekhar, JSA, as Technical Assistant (T II-3)

Shri P. Sadasiva Sarma, JSA, as Technical Assistant (T II-3)

Shri P. Karunakaran Nair, JSA, as Technical Assistant (T II-3)

Shri P. K. Mahadevan Pillai, JSA, as Technical Assistant (T II-3)

Shri K.N. Rasachandra Kartha, JSA, as Technical Assistant (T II-3)

Shri R. Raghu, JSA, as Technical Assistant (T II-3)

Shri K. Ramakrishnan Nair, JSA, as Technical Assistant (T II-3)

Shri R. Bhaskaran Achari, JSA, as Technical Assistant (T II-3)

Shri N. Retnasamy, JSA, as Technical Assistant (T II-3)

Shri A.A.P. Mudaliar, JSA, as Technical Assistant (T II-3)

Shri K. C. Yohannan, JSA, as Technical Assistant (T II-3)

Shri T. Girijavallabhan, JSA, as Technical Assistant (T II-3)

Shri R. Gurnawami, JSA, as Technical Assistant (T II-3)

Shri M. Babu Philip, JSA, as Technical Assistant (T II-3)

Shri A.A. Thankappan, JSA, as Technical Assistant (T II-3)

Shri K. Nanalakumaran, JSA, as Technical Assistant (T II-3)

Shri N. P. Kunhikrishnan, JSA, as Technical Assistant (T II-3)

Shri R. Ganapathi, JSA, as Technical Assistant (T II-3)

Shri P. Ananda Rao, JSA, as Technical Assistant (T II-3)

Shri A. Chellam, JSA, as Technical Assistant (T II-3)

Shri M. V. Somaraju, JSA, as Technical Assistant (T II-3)

Shri M. Ayyappan Pillai, JSA, as Technical Assistant (T II-3)

Shri M. Barudeen, JSA, as Technical Assistant (T II-3)

Shri V. K. Balachandran, JSA, as Technical Assistant (T II-3)

Shri M. Mohamed Sultan, JSA, as Technical Assistant (T II-3)

Shri T. G. Vijaya Warrier, JSA, as Technical Assistant (T II-3)

Shri J.J. Joel, JSA, as Technical Assistant (T II-3)

Shri A. Hanumantha Rao, JSA, as Technical Assistant (T II-3)

Shri A. Rastin Fernando, JSA, as Technical Assistant (T II-3)

Shri C. V. Seshagiri Rao, JSA, as Technical Assistant (T II-3)

Shri V. Gandhi, JSA, as Technical Assistant (T II-3)

Shri S. G. Vincent, JSA, as Technical Assistant (T II-3)

Shri K. K. Balasubrahmanian, JSA, as Technical Assistant (T II-3)

Shri S. Palanichamy, LFA, as Jr. Technical Assistant (T-2)

Shri M. Gopala Prabhu, LFA, as Jr. Technical Assistant (T-2)

Shri S. Seethu Raman, LFA, as Jr. Technical Assistant (T-2)

Shri M. Jayachandran, LFA, as Jr. Technical Assistant (T-2)

Miss K. Umakumari, LFA, as Jr. Technical Assistant (T-2)

Shri N. S. Viswanath, LFA, as Jr. Technical Assistant (T-2)

Shri Sapan Kumar Ghosh, LFA, as Jr. Technical Assistant (T-2)

Shri Hameed Batcha, LFA, as Jr. Technical Assistant (T-2)

Shri G. Surendranath, LFA, as Jr. Technical Assistant (T-2)

Shri S. Subramani, LFA, as Jr. Technical Assistant (T-2)

Shri N. Thiruprakasam, Packiaraj, LFA, as Jr. Technical Assistant (T-2)

Shri K.L.K. Kesavan, Artist, as Artist (T-2)

Shri K. Muniyandi, Artist, as Artist (T-2)

Shri M. A. Vincent, II Class Driver, as Driver (Boat) (T-1)

Shri M. Musthaffa, Serang, as Driver (Boat) (T-2)

Shri A. Pathrose, Serang, as Driver (Boat) (T-2)

Shri S.G. Kulgutkar, Serang, as Driver (Boat) (T-2)

Shri S. Mohammed Shaffee, Bosun, as Bosun (T I-3)

Shri P. Ferozkhan, Bosun, as Bosun (T I-3)

Shri K. K. Prabhakaran, Cook (Boat), as Cook (Boat) (T-1)

Shri E. Sivanandam, Cook (Boat), as Cook (Boat) (T-1)

Shri C. K. Dandapani, Serang, as Serang (T-1)

Shri C.M. Jainulabdeen, Serang, as Serang (T-1)

Shri K. Kanakasabhapathi, Sr. Library Assistant, as Sr. Library Assistant (T II-3)

Shri E. Johnson, Jr. Library Assistant, as Sr. Library Assistant (T II-3)

Miss S. Girija Kumari, Jr. Library Assistant, as Jr. Library Assistant (T-2)

Shri M. Alagarsamy, Motor Driver, as Motor Driver (T-2)

Shri K. Kuruppaiah, Motor Driver, as Motor Driver (T-2)

Shri P. C. Appukuttan, Motor Driver, as Motor Driver (T-2)

Shri A. Kondan Chettiar, Motor Driver, as Motor Driver (T-2)